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VOLUME X

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VOLUME X

CRUSTACEANS

BY

MARY J. RATHBUN, HARRIET RICHARDSON,
S. J. HOLMES, and LEON J. COLE



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HARRIMAN ALASKA EXPEDITION
WITH COOPERATION OF WASHINGTON ACADEMY OF SCIENCES

ALASKA

VOLUME X

CRUSTACEANS

BY MARY J. RATHBUN, HARRIET RICHARDSON,
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PREFACE

Crustaceans were collected by several members of the Harriman Expedition, particularly by Professor Trevor Kincaid, Professor W. B. Ritter, and Dr. Wesley R. Coc. After the return of the Expedition these specimens were arranged by groups and sent to specialists for study. The Decapods have been elaborated by Miss Mary J. Rathbun, who has included in her investigation the extensive collections from the Pacific coast already in the United States National Museum, so that her paper may be regarded as a comprehensive revision of the group for the west coast of North America from California to Arctic Alaska. The Isopods have been treated by Miss Harriet Richardson, the Amphipods by Dr. S. J. Holmes, the Pycnogonids by Dr. Leon J. Cole. The chapter headings are from the facile pens of Mrs. Louise M. Keeler and Mr. F. A. Walpole—the Amphipods by Mr. Walpole, the others by Mrs. Keeler.

C. HART MERRIAM,
Editor.

WASHINGTON, D. C.,
May 1, 1903

DECAPOD CRUSTACEANS
OF THE NORTHWEST COAST OF
NORTH AMERICA



DECAPOD CRUSTACEANS OF THE NORTHWEST COAST OF NORTH AMERICA

BY MARY J. RATHBUN

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INTRODUCTION.

THIS report includes primarily the crabs and shrimps collected by the Harriman Expedition. In order to name the shrimps it became necessary to overhaul the large collection of undetermined material of that group which has accumulated in the U. S. National Museum. This was derived from several years' work of the *Albatross*, and from the investigations of Dr. W. H. Dall and others, and embraces the entire coast from Arctic Alaska to southern California. The results of this study are given below, short descriptions of the new species having already been published in the Proceedings of the National Museum (XXIV, pp. 885-905, May, 1902). More than that, the accompanying list of species is designed to serve as a check-list of the Decapoda¹ known to inhabit the region indicated, together with their distribution.

The collection in the National Museum affords exceptional

¹ The Anomura of the Museum collection, here listed, have been determined by Dr. J. E. Benedict. The Alpheidae are to be reported upon by Dr. H. Coutière of the Museum at Paris; therefore the data given herein are quoted largely from Dr. Holmes.

opportunities for studying the Pacific fauna, as the material is in some cases remarkably abundant. So rich in crabs and shrimps were some parts of the sea bottom explored by the *Albatross* that only a portion of each dredge haul was preserved for study, many a 'peck' or 'quart' of these animals being thrown overboard by the ship's naturalists.

Our knowledge of the Decapod fauna of the Northwest is, for the most part, of recent growth. More than two fifths of the species enumerated below have been described within the last twelve years, while during that time our acquaintance with the species known to Brandt, Stimpson, Lockington, and other pioneers in this field has been greatly extended.

In 1900 Dr. S. J. Holmes published a very useful 'Synopsis of California Stalk-Eyed Crustacea,'¹ with descriptions of genera and species, and it has been thought unnecessary to repeat citations for the species which he gives. An effort has been made to figure all the little-known species.

In addition to the general collection of Decapods made by Dr. William E. Ritter of the Harriman Expedition, those obtained by Dr. W. R. Coe and Professor Trevor Kincaid have been placed at my service.

One new species, a *Betaeus*, is notable as the first Alpheid reported from as high a latitude as Sitka.

A remarkable case of dimorphism is here recorded for the first time: the cosmopolitan species *Processa canaliculata* Leach, more commonly known by the later name *Nika edulis* Risso, is found to possess in certain cases two chelate feet of the first pair instead of the characteristic asymmetrical disposition of a chelate foot on one side and a simple one on the other.

General features.—The Decapod fauna of the North Pacific is rich in individuals, if not in species or in variations of form.

In the mass of material examined (about 50,000 specimens) certain types were found to be largely in excess, namely, the Pandalid, Hippolytid, and Crangonid shrimps, the Pagurids or hermit-crabs, the Maioids or true spider-crabs, and the Lithodids or Anomuran spider-crabs.

In point of numbers the Pandalids take the lead. The most

¹ Occas. Papers Calif. Acad. Sci., VII, pp. 1-262, pls. 1-IV, 1900.

abundant species are *Pandalus borealis* and *P. montagui*, both boreal forms which descend from the Arctic regions into the Atlantic as well as the Pacific, but in the latter find conditions most favorable to their increase. The form of *P. montagui* inhabiting the Pacific exhibits modifications which entitle it to recognition as a distinct subspecies.

In number of species the genus *Spirontocaris* of the family Hippolytidæ is unsurpassed. Like *Pandalus*, it is primarily a boreal genus, and is common to the Atlantic and the Pacific. In the Pacific it is represented by 51 species, exhibiting great diversity in form. Several are identical with Atlantic species.

Quite as conspicuous in the North Pacific fauna are the Crangonidæ. These occur in great numbers, and exhibit 32 different forms, for the most part restricted to the Pacific.

The Paguridæ, or hermit-crabs, occur in vast numbers, and some of the species appear to have local centers of distribution. Each of these species attains its maximum development, both as to size and numbers, in a particular area, while elsewhere it is stunted and infrequent.

Several of the spider-crabs (Maidæ) abound in shallow as well as in deeper water, and *Oregonia*, *Chorilia*, the two *Chionectes*, and the two species of *Ilyas* form no inconsiderable part of every haul of the dredge.

Less abundant are the Lithodidæ or Anomuran spider-crabs, which include the giant Decapods of the region.

The crowding of crustacean life in certain localities is especially favorable to parasitism. Bopyrids (of a few species only) are of frequent occurrence on many species of shrimps¹; Rhizocephalids are less common, while worm parasites have been noticed in several instances embedded underneath the carapace of *Spirontocaris*.

The Decapods contribute without doubt a large proportion of the food of fishes, several species having been taken from their stomachs; but our knowledge on this subject is very fragmentary.

Many species are caught for the market, to be used for the table or for bait. The list of these furnished in 'The Fisheries and Fishery Industries of the United States,' Washington, 1884,

¹ Miss Harriet Richardson will publish a report on the Bopyridæ of the Museum collection in the Proceedings of the U. S. National Museum during the next year.

is the only one so far published, but it is necessarily incomplete.

Geographic distribution.—The following points are brought out in the accompanying table of distribution :

That Arctic species often continue southward through Bering Strait along the west coast of Bering Sea to Okhotsk Sea and the Kurile Islands.

That some of these species may also stretch along the Alaska shores southward, occasionally to Puget Sound or even farther south.

That the winter line of floating ice in Bering Sea determines the northern limit of many species. This line extends approximately from the neighborhood of Nunivak Island westward just north of the Pribilof and Commander Islands to the Kamchatkan shore.

While many species range continuously from this line southward to California, others indicate a division of that stretch of coast-line into several faunæ. So far as the Crustacea are concerned, the vicinity of Kadiak appears to be a boundary between subregions. Aleutian species, however, are often found out of their normal region, in the cold glacier-fed bays and sounds of southeastern Alaska.

The Straits of Fuca and Puget Sound also form a partial boundary between species, partial because, while nineteen species have Puget Sound for a southern limit, and nine species find here their northern limit, seventy others run uninterruptedly north and south of this point.

The vicinity of Monterey Bay, California, is a more striking barrier to species than those above mentioned, the crustacean fauna south of that promontory being strongly Mexican or Lower Californian in character.

In exceptional cases, as in *Philyra pisum* and *Cancer amphixatus*, a Japanese species is found to occur in approximately the same latitude on the American coast, without obvious connection by way of Alaska.

As is to be expected, the inhabitants of the deeper waters of Bering Sea (below 500 fathoms) are likely to extend much farther south in the North Pacific Ocean than the shoal-water

species which follow the coast-line. The occurrence of some abyssal forms, as *Hymenodora glacialis* and *H. frontalis*, in the deep pocket (1569 fathoms) east of Prince of Wales Island is worthy of note.

The following is a list of the genera occurring below the 500-fathom line. Those whose range extends below 1000 fathoms are printed in italics:

<i>Pasiphaea</i>	Pagurus (2 species)
Parapasiphaea	Parapagurus
<i>Acanthephyra</i>	Pristopus
<i>Hymenodora</i>	Leptolithodes
Pandalopsis (1 species)	Lithodes
Spirontocaris (5 species)	Munida
<i>Crangon</i> (3 species)	<i>Munidopsis</i>
<i>Sergestes</i>	Chorilia
<i>Benthescymnus</i>	<i>Chionæctes</i>
<i>Gennadas</i>	Hyas
Calastacus	

Dr. Dall¹ divides his Oregonian fauna, which stretches from the end of the Aleutian chain to Point Conception, California, into three subfaunal areas, with divisions at Yakutat Bay or Mount St. Elias, Alaska, and at Cape Mendocino, California.

Professor Nutting,² on the other hand, reasoning from his study of the Hydroids, emphasizes the effectiveness of Puget Sound as a faunal barrier and the continuity of the area between that point and the end of the Aleutian chain.³

It is highly probable that future research will make it possible to subdivide the coast into several small areas. The accompanying table shows the intricate overlapping of species.

¹ The Fur Seals and Fur-Seal Islands of the North Pacific Ocean, Pt. III, 539-546, 1899.

² Proc. Wash. Acad. Sci., III, 161, 1901.

³ Professor Nutting had not consulted Dr. Dall's report above cited, in which statements made twenty-three years earlier are considerably modified.

DECAPODS OF THE NORTHWEST COAST OF NORTH AMERICA—Continued

Species	Arctic Alaska.	Bering Sea.	Aleutian Islands to Kadiak.	Kadiak to southeastern Alaska.	British Columbia.	Puget Sound and Strait of Fuca.	West coast of Washington and Oregon.	California from northern limit to Monterey.	Monterey to San Diego.	San Diego and southward.	Kamchatka, east coast.	Okhotsk Sea.	Japan.	Circumpolar.	East coast North America.	Europe, south of Arctic Ocean.	Indian Ocean.	Above 50 fathoms.	50-100 fathoms.	100-500 fathoms.	500-1000 fathoms.	1000-2500 fathoms.
<i>Spirontocaris townsendi</i>																						
<i>Spirontocaris suckleyi</i>	x	x	x	x	x	x	x	x	x	x												
<i>Spirontocaris moseri</i>		x	x	x	x	x	x	x	x	x												
<i>Spirontocaris maxillipes</i>																						
<i>Spirontocaris brachydactyla</i>																						
<i>Spirontocaris camtschatica</i>		x	x	x	x	x	x	x	x	x												
<i>Spirontocaris kincaidii</i>				x																		
<i>Spirontocaris blunguis</i>		x	x	x	x	x	x	x	x	x												
<i>Spirontocaris layi</i>					x																	
<i>Spirontocaris palpator</i>					x																	
<i>Spirontocaris brevirostris</i>																						
<i>Spirontocaris pusilla</i>																						
<i>Spirontocaris herdmanni</i>																						
<i>Spirontocaris taylori</i>																						
<i>Spirontocaris picta</i>																						
<i>Spirontocaris paludicola</i>																						
<i>Spirontocaris sitchensis</i>																						
<i>Spirontocaris cristata</i>																						
<i>Spirontocaris stoneyi</i>																						
<i>Spirontocaris avina</i>	x	x	x	x	x	x	x	x	x	x												
<i>Spirontocaris maculenta</i>																						
<i>Spirontocaris macrophthalma</i>																						
<i>Alpheus dentipes</i>																						
<i>Alpheus bellimanus</i>																						
<i>Alpheus barbara</i>																						

DECAPODS

II

[illegible]

1 To Port Etches. 2 To Point Sur. 3 Bermudas: West Indies. 4 Mediterranean. 5 Chile. 6 Japan and Amboina. 7 North Carolina southward. 8 Kurile Islands.

DECAPODS OF THE NORTHWEST COAST OF NORTH AMERICA—*Continued*

Species	
Nectocrangon levior.....	.
Purcrangon echinata.....	.
Sergestes alanicus.....	.
Sergestes sp. ....	.
Penaeus brevirostris.....	.
Bemhesicrurus tanneri.....	.
Gennadas borealis.....	.
Gennadas sp. ....	.
Pandalus interruptus.....	.
Axiopsis spinulicauda.....	.
Calastacus investigatoris.....	.
Calastacus quinquevittatus.....	.
Upogebia pugetensis.....	.
Callinassa californiensis.....	.
Callinassa longimana.....	.
Callinassa gigas.....	.
Callinassa affinis.....	.
Callinassa gonioptera.....	.
Pagurus alaskensis.....	.
Pagurus aleuticus.....	.
Pagurus ochotensis.....	.
Pagurus trigonocheirus.....	.
Pagurus capillatus.....	.
Pagurus brevidactylus.....	.
Pagurus dalli.....	.
	Arctic Alaska.
	Bering Sea.
	Aleutian Islands to Kodiak.
	Kodiak to southeastern Alaska.
	British Columbia.
	Puget Sound and Strait of Fuca.
	West coast of Washington and Oregon.
	California from northern limit to Monterey.
	Monterey to San Diego.
	San Diego and southward.
	Kamchatka, east coast.
	Okhotsk Sea.
	Japan.
	Circumpolar.
	East coast North America.
	Europe, south of Arctic Ocean.
	Indian Ocean.
	Above 50 fathoms.
	50-100 fathoms.
	100-500 fathoms.
	500-1000 fathoms.
	1000-2500 fathoms.

[illegible]

Florida to Rio de Janeiro; Bermudas.

Japan, Korea, and Philippine Islands.

■ Also Brazil

[illegible]

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SYSTEMATIC DISCUSSION OF SPECIES.

Suborder **MACRURA.**Family **PASIPHÆIDÆ.**Genus **Pasiphæa** Savigny.

KEY TO THE SPECIES OF PASIPHÆA.

- A. Carapace carinated throughout its length.
 - B. Telson truncate, not forked or notched *magna*.
 - B'. Telson forked or notched.
 - C. Branchiostegal spine over the angle of the antero-lateral sinus *pacifica*.
 - C'. Branchiostegal spine farther forward, near or on anterior margin.
 - D. Telson longer than sixth segment *emarginata*.
 - D'. Telson shorter than sixth segment.
 - E. Abdomen carinate *princeps*.
 - E'. Abdomen not carinate *corteziana*.
- A'. Carapace not carinated in its posterior half *affinis*.

PASIPHÆA MAGNA Faxon?

Pasiphæa magna FAXON, Bull. Mus. Comp. Zool., XXIV, 209, 1893; Mem. Mus. Comp. Zool., XVIII, 176, pl. XLV, figs. 2-2c, 1895. Gulf of Panama, 458 fathoms.

Distribution.—From off Point Arena, California, to Gulf of Panama; 265 to 552 fathoms.

Dredged by the *Albatross* at the following localities:

- Off Point Arena, California, 455 fathoms, station 3348.
- Off the Farallones, California, 552 fathoms, station 3162.
- Off San Francisco, California, 276 fathoms, station 3479.
- Off Pigeon Point, California, 296 fathoms, station 3112.
- Off Monterey Bay, California, 418-456 fathoms, stations 3126, 3127.
- Off Point Sur, California, 328 fathoms, station 3186.

The identification of these specimens with *P. magna* is doubtful, but as I have not had the opportunity of comparing them with the type, they are placed here provisionally. Though from the same depth of water, the integument is much firmer in our examples than in the type, the carapace is deeper and its dorsal outline less arched, the branchial ridge is straighter throughout the posterior half of its course, the palm in the first pair of chelæ is longer than the fingers.

The largest specimen, an ovigerous female from station 3348, is 155 mm. long. The telson is a little longer than the sixth segment of

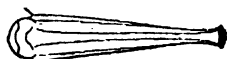


FIG. 1. *Pasiphæa magna*. Telson (× 1½). Station 3348.

the abdomen, and reaches about to the end of the inner uropod; it is broadly channeled, extremity truncate or slightly convex, and armed with about 13 slender bristles. Eyes brown in alcohol. In the first pair of legs the palm is about one third longer than the fingers; in the second pair the right merus has 14 spines, the left 13.

PASIPHÆA PACIFICA Rathbun.

Pasiphæa pacifica RATHBUN, Proc. U. S. Nat. Mus., XXIV, 905, 1902.

The carapace is a little less than half the length of the abdomen, measured on the median line; it is laterally compressed and rises into a well-marked ridge extending nearly to the posterior margin and terminating anteriorly in the median tooth; the ridge is rounded except on

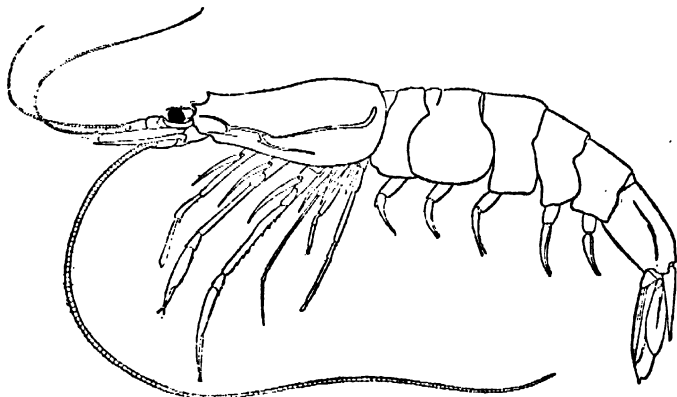


FIG. 2. *Pasiphæa pacifica*. ♀ ($\times 1\frac{1}{2}$). Station 3186.

the forward part of the gastric area, where it forms a thin, sharp keel terminating in a sharp pointed tooth, which is not nearly so advanced as the anterior margin. This tooth is variable, being more or less inclined upward; its terminal portion is usually slender, its anterior margin concave. Median tooth of frontal margin narrow, rounded; infra-orbital and antennal angles rounded and ill-defined; antero-lateral angle rounded and slightly obtuse. Behind this angle the antero-lateral margin runs almost directly backward for a short distance, then turns abruptly downward, forming an obtuse angle, and joins obliquely the infero-lateral margin. Above this sinus there is a sharp spine on a level with the middle of the basal segment of the antenna. There is a well-defined blunt ridge on each side of the carapace, running from the

hepatic area backward over the branchial region nearly to the posterior border of the carapace.

Eyes of moderate size, subglobular on somewhat smaller cylindrical stalks, the corneæ of a dark brownish color.

The flattened antennular spine does not reach the end of the basal segment; both of the flagella exceed the carapace in length. The second antennæ exceed in length the whole body; there is an acute spine on the peduncle below the articulation of the scale; the scale is long-oval, armed with a spine at the distal end, and overreaches the antennular peduncle by a third of its length.

The third maxillipeds extend as far forward as the end of the antennal scale.

The first pair of legs, when extended forward, surpass the third maxillipeds by the length of the dactylus; the merus is either unarmed, or may have one, two, or even three spines; the basal part of the propodal segment is half again as long as the dactylus. The second pair of legs are longer than the first by about half the length of the fingers, and have longer and more slender chelæ; the second segment is armed with a small spine at the distal end of its inferior margin. The third pair reaches forward a little beyond the proximal end of the chela of the preceding pair; except for the first two segments, they are thread-like; all the segments are naked and unarmed; the merus is about one half the length of the whole appendage, and more than twice as long as the propodus. The fourth pair of legs reaches scarcely to the middle of the merus of the second pair; the lower margin of the dactylus, propodus, and distal half of the carpus is fringed with bristles. The fifth pair, when extended, reach to the middle of the merus of the second pair; the dactylus is elongate-oval, the margin of its distal half fringed with long setæ.

The second to sixth abdominal segments inclusive are carinated on the median line. The sixth segment is from two thirds to three fourths longer than the fifth; it is marked on either side by a curved longitudinal ridge. Telson four fifths as long as sixth segment; dorsal surface channeled; extremity with a deep notch, bordered by spinules, which increase in size and are continued to the posterior outer angle of each lobe; the outer spinule is considerably longer than the others and is very often broken off.

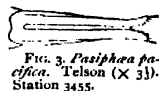


FIG. 3. *Pasiphaea pacifica*. Telson ($\times 33$). Station 3455.

Dimensions.—Length of female, 64.8 mm.; length of carapace, 20.3 mm.

Distribution.—This species occurs sparingly from Unalaska and the

Gulf of Alaska southward to the Gulf of California, in 53 to 399 fathoms (one specimen from 13 fathoms, if the label be correct). The following are the specific localities of the *Albatross* represented:

North of Unalaska, 399 fathoms, station 3329.

Portlock Bank, Alaska, 230 fathoms, station 2858.

Off Queen Charlotte Sound, British Columbia, 204 fathoms, station 2861.

Queen Charlotte Sound, British Columbia, 238 fathoms, station 2862.

Gulf of Georgia, British Columbia, 67 fathoms, station 2863.

Strait of Fuca, 135-152 fathoms, stations 3449, 3454-3456.

Puget Sound, 82 fathoms, station 3067.

Off Tahwhit Head, Washington, 178 fathoms, station 3076.

Off Pigeon Point, California, 296 fathoms, station 3112.

Monterey Bay, California, 13-382 fathoms, stations 3134, 3202, 3669.

Off Point Sur, California, 316, 328 fathoms, stations 3188, 3186 (type).

Off San Simeon Bay, California, 53 fathoms, station 3191.

Off San Luis Obispo Bay, California, 252 fathoms, station 3195.

Off Point Conception, California, 278, 284 fathoms, stations 3198, 2892.

Santa Barbara Channel, California, 233-280 fathoms, stations 2840, 2960, 3199, 3200, 3201.

Off San Miguel Island, California, 376 fathoms, station 2896.

Off Santa Cruz Island, California, 266, 269 fathoms, stations 2947, 2948.

Off San Diego, California, 339 fathoms, station 2925.

Gulf of California, northwest of Tiburon Island, 145 fathoms, station 3015.

Our species differs from the others with carinated carapace in having the branchiostegal spine situated above the angle of the antero-lateral sinus.

PASIPHÆA EMARGINATA Rathbun.

Pasiphaea emarginata RATHBUN, Proc. U. S. Nat. Mus., XXIV, 905, 1902.

I have proposed the name *P. faxoni* for *P. acutifrons* Faxon, not Bate. There are in the National Museum specimens which I believe to be *P. acutifrons* Bate, from the west coast of Patagonia, 194 fathoms, station 2784, *Albatross*. *P. faxoni* differs from them in the broader median lobe of the front; in the antero-lateral sinus being an obtuse angle, while in *P. acutifrons* it is a right angle or less; in the sixth abdominal segment compressed, blunt above, scarcely carinate, in *P. acutifrons* sharply carinate; in the telson much shorter than the sixth segment, in *P. acutifrons* very little shorter; in its shallower notch, which is broader than long.

P. emarginata differs from *P. faxoni* as follows:

The median carina is less sharp and less prominent; the gastric tooth smaller; the carapace proportionally higher in its posterior portion, the branchial ridge more sinuous; the carapace relatively longer, being equal to the first five segments and half of the sixth segment of the abdomen;

the telson is longer than the sixth segment, and at the posterior end is notched with a very shallow V-shaped sinus, so shallow that the extremity can hardly be called 'forked.'

Dimensions.—Length of female 81 mm., of carapace 33.3 mm.

Distribution.—Santa Barbara Channel, California, 265 to 322 fathoms

(*Albatross* stations 2903, 2904, 2960, 3200, and 3201). Gulf of California, off Concepcion Bay, Lower California, 857 fathoms, station 3009 (type locality).

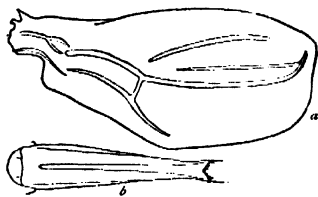


FIG. 4. *Pasiphaea emarginata*. a. Station 3009. a. Side view of carapace (X 14). b. Telson (X 34).

PASIPHÆA PRINCEPS Smith.

Pasiphaea princeps SMITH, Rept. U. S. Commr. Fish and Fisheries for 1882, p. 381, pl. v, fig. 2 (1884); *op. cit.* for 1885, p. 682 (1886).

Pasiphaea princeps FAXON, Mem. Mus. Comp. Zool., XVIII, 175, 1895.

One large female, 167 mm. long, was dredged by the *Albatross* off Sea Lion Rock, Washington, in 859 fathoms, station 3075; and one small specimen about 47 mm. long, north of Unalaska, in 399 fathoms, station 3329.

I have at hand only one specimen determined by Professor Smith. It was taken south of Marthas Vineyard in 538 fathoms, at station 2546. It measures 150 mm. long. It differs from the type in having the carina of the posterior two thirds of the carapace well marked though blunt, in the gastric tooth projecting well beyond the frontal margin, the anterior (or inferior) margin of this spine contiguous with the dorsal surface of the carapace in advance of the spine, and in having the merus of the first and second pairs of feet armed with numerous spines (instead of the first pair unarmed and the second pair few-spined). The antero-lateral sinus is rectangular, as in the figure of the type.

In five smaller specimens from off Cape Romain, South Carolina, 353 fathoms, station 2626, and two from off Marthas Vineyard, 349 fathoms, station 1093, the gastric tooth projects only a little beyond the frontal margin, and the antero-lateral sinus has margins oblique to each other; otherwise as in the preceding.

In the specimen from off Ecuador described by Faxon (*loc. cit.*) the merus of the first pair of feet is unarmed.

The Washington specimen agrees quite closely with that from station 2546, excepting that the median carina of the carapace is sharper along its posterior two thirds. The small individual from Bering Sea may

prove to be distinct; the gastric spine is shaped as in the figured type, but a little narrower and more ascending; the merus of the first pair of feet has one or two spines, of the second pair many spines.

Distribution.—North Atlantic, from lat. $39^{\circ} 56' 00''$ N., long. $69^{\circ} 45' 00''$ W. to lat. $32^{\circ} 27' 30''$ N., long. $77^{\circ} 20' 30''$ W., 349 to 1342 fathoms. North Pacific: Bering Sea, 399 fathoms; Washington, 859 fathoms. Ecuador, 1132 fathoms.

PASIPHÆA CORTEZIANA Rathbun.

Pasiphæa corteziana RATHBUN, Proc. U. S. Nat. Mus., XXIV, 905, 1902.

Carapace equal to the first five segments and part of the sixth segment of the abdomen. Gastric tooth dentiform, continued back in a very blunt carina; tip acute, upper margin nearly horizontal, anterior margin inclined slightly forward and upward, not as produced as the anterior margin of the carapace. Median lobe of front triangular, obtuse. Branchiostegal spine small, inserted near the antero-lateral angle just behind the anterior margin. Antero-lateral sinus with sides forming an obtuse angle.

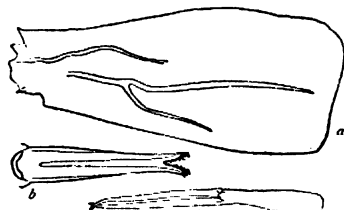


FIG. 5. *Pasiphæa corteziana*. Station 3627. a. Side view of carapace ($\times 2$). b. Telson ($\times 2\frac{1}{2}$). c. Hand of second pair ($\times 2\frac{1}{2}$).

The eye-stalks are only slightly enlarged distally, the corneæ reddish brown. The flattened antennular scale falls short of the end of the

first peduncular segment. End of antennular scale more lobiform than in *P. pacifica*. The merus of the first pair of legs is armed with 3 or 4 spines; of the second pair, with many spines. Distal end of second segment of second pair ending in a small spine; fingers longer than palm.

Abdomen without median carina. Telson very nearly as long as the sixth segment, and forked with a deep sinus.

For the rest, almost as in *P. pacifica*.

Dimensions.—Length of male 64 mm., of carapace 23.8 mm.

Type locality.—Near Cortez Bank, Calif., in lat. $32^{\circ} 44' 00''$ N., long. $119^{\circ} 32' 00''$ W., 776 fathoms (*Albatross* station 3627).

PASIPHÆA AFFINIS Rathbun.

Pasiphæa affinis RATHBUN, Proc. U. S. Nat. Mus., XXIV, 905, 1902.

Very closely related to *P. corteziana*.

Carapace equal to the first four segments and half of the fifth seg-

ment of the abdomen; not carinated behind gastric tooth; outline much as in the preceding, as are also the eyes and antennæ. Second to sixth abdominal segments inclusive carinate; telson very nearly as long as the sixth segment, less deeply notched than in *Pasiphaea corteziana*.

The side view strongly resembles that of *P. corteziana*, from which the carinated abdomen and shorter carapace without median carina at once distinguish it.

Dimensions.—Length of male 67 mm., length of carapace 22 mm.

Type locality.—Near Cortez Bank, Calif., lat. $32^{\circ} 17' 00''$ N., long. $119^{\circ} 17' 00''$ W., 984 fathoms (*Albatross* station 2919).

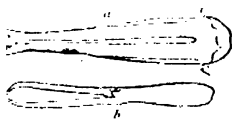


FIG. 6. *Pasiphaea affinis*. Station 2919. a. Telson ($\times 3\frac{1}{2}$). b. Hand of second pair ($\times 2$).

Genus *Parapasiphae* Smith.

PARAPASIPHÆ SERRATA Rathbun.

Parapasiphae serrata RATHBUN, Proc. U. S. Nat. Mus., XXIV, 904, 1902.

Carapace and rostrum as long as the first five abdominal somites. The median carina extends backward to the posterior fifth of the cara-

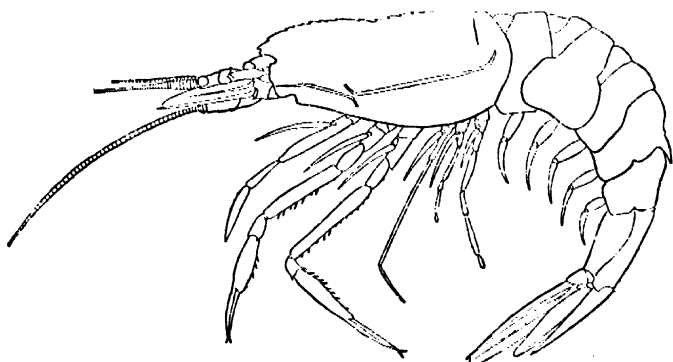


FIG. 7. *Parapasiphae serrata*. ♀ (\times about $1\frac{1}{2}$). Station 2919.

pace or the cervical groove, and forward along the high thin rostrum which reaches half way along the eye-stalks; the carina is a little concave at the middle of the carapace and anteriorly slopes downward, and is armed with 16 small teeth or spines, two of which are on the rostrum and one is terminal; below this spine the rostrum is a compressed, finely crenulate lobe. Orbital and antennal angles blunt. There is a small spine just behind the orbital angle, and another still farther back in a

line with the acicle. The branchiostegal sinus is rectangular, the angle rounded. From the post-antennal spine a ridge runs nearly straight back, with one interruption, almost to the posterior margin. A groove runs from just in front of the middle of the posterior margin vertically half way down the carapace.

Eyes light brown, almost colorless in alcohol, nearly as wide as their stalks. The antennular scale, which is foliaceous and has a sharp spine at the upper extremity, is as long as the basal joint of the peduncle. Antennal scale nearly half as long as carapace proper, elongate-oval, with a stout midrib, and its outer border thickened and ending in a slender terminal spine.

The external maxillipeds, which are stouter than any of the last three pairs of legs, reach almost to the tip of the antennal scale; all their joints are setose; the antepenultimate segment is broadened in its middle portion, tapering at each end.

The first two pairs of legs are similar in form, the second pair the longer and about half the length of the body. In the first pair, the posterior border of the merus and palm are spinous, and the distal angles of the wrist are produced; the fingers equal the palm in length. In the second pair, the posterior border of the basis, ischium, merus, and palm is spinous; the angles of the wrist are more strongly produced; the fingers are nearly as long as the palm. In each case the hand forms about two fifths of the entire length. The filiform third pair (tip broken off) are equal in length to the carapace exclusive of the rostrum. The fourth and fifth pairs have the terminal joint narrow-oval; the fifth pair are the longer and two thirds the length of carapace.

The first three abdominal somites are non-carinate, the fourth is posteriorly produced in a thin compressed spine which is carinate and has a slight notch at its base, visible in profile; the sixth has a longitudinal groove on either side. The telson is a little longer than the sixth somite, shorter than the inner uropod, and much shorter than the outer one; it is truncate at the tip.

Dimensions.—In an egg-laden female the length of the carapace and rostrum is 23.6 mm., the rostrum 1.8 mm., the abdomen 42 mm.

Type locality.—Off Cortez Bank, Calif., 984 fathoms (*Albatross* station 2919), one female.

This species is akin to *P. gilesii* Wood-Mason, from the Indian Ocean, which also has a serrated carina running the whole length of the carapace, but the character of the rostrum alone separates it distinctly from that species. In *P. gilesii*, the rostrum is a fine, acute, upcurved spine, extending about a third of its length beyond the eyes.

Family *OPLOPHORIDÆ*.Genus *Acanthephyra* A. Milne Edwards.

ACANTHEPHYRA CURTIROSTRIS Wood-Mason.

Acanthephyra curtirostris WOOD-MASON, Ann. Mag. Nat. Hist. (6), vii, 195, 1891; ix, 364, fig. 5, 1892. Ill. Zool. Investigator, Crustacea, pl. iii, fig. 4, 1892.—FAXON, Mem. Mus. Comp. Zool., xviii, 164, pl. XLIII, figs. 2-5, 1895.—ALCOCK, Desc. Cat. Indian Deep-Sea Crust., 81, 1901.

Distribution.—Arabian Sea, 937-1043 fathoms; Bay of Bengal, 364-913 fathoms; Andaman Sea, 922 fathoms (Alcock). From off San Diego, California, to off Gulf of Panama, 458-2232 fathoms. Off San Diego, 623 fathoms, one male of the typical form (*Albatross* station 2929); Gulf of California, 857 and 1005 fathoms (*Albatross* stations 3009 and 3010); see also Faxon, *loc. cit.*

Genus *Hymenodora* Sars.

KEY TO THE SPECIES OF HYMENODORA.

- A. Rostrum very short, not reaching beyond the first antennular segment *glacialis*.
 A'. Rostrum reaching end of antennular peduncle *frontalis*.

HYMENODORA GLACIALIS (Buchholz).

Pasiphae glacialis BUCHHOLZ, Zweite Deutsche Nordpolarfahrt, II, 279, pl. I, fig. 2, 1874.

Hymenodora glacialis G. O. SARS, Arch. for Math. og Naturvid., II, 241, 1877; Norske-Nordhavs-Exped., Crustacea, I, 37, 275, pl. IV, 1885.—SMITH, Proc. U. S. Nat. Mus., VII, 501, 1885 (part); Rept. U. S. Fish Commr. for 1885, 678, pl. XV, figs. 3, 10, pl. XVI, fig. 5, 1886.

Distribution.—Between Norway and Greenland, lat. 63° to 80° N., 452 to 1862 fathoms (Norwegian North Atlantic Expedition); Faroe Channel (*Knight Errant*). East coast of North America (U. S. Fish Commission): Lat. 42° 48' 00" N., long. 50° 55' 30" W., 826 fathoms (station 2428); lat. 40° 03' 30" N., long. 67° 27' 15" W., 1149 fathoms (station 2535); lat. 38° 19' 26" N., long. 68° 20' 20" W., 2369 fathoms (Smith); lat. 37° 12' 20" N., long. 69° 36' 00" W., 2949 fathoms (Smith). Bering Sea, south of Pribilof Islands, 1401 fathoms (station 3604), 1 ♀. East of Prince of Wales Island, Alaska, 1569 fathoms (station 2859), 2 ♂. Gulf of California, 857 fathoms (station 3009); 905 and 1218 fathoms (Faxon). Gulf of Panama, 1832 fathoms (Faxon). Off Ecuador, 1740 fathoms (Faxon).

HYMENODORA FRONTALIS Rathbun.

Hymenodora frontalis Rathbun, Proc. U. S. Nat. Mus., xxiv, 904, 1902.

Integument very thin, but firmer than in *H. glacialis*; covered with fine wrinkles or rugose lines. Carapace and rostrum more than half as long as abdomen; median carina extending almost or quite to the middle of the carapace, and advanced in a rostrum which is unusually long for the genus, being from two fifths to one half as long as the remainder of the carapace, and reaching the end or a little beyond the end of the antennular peduncle. The rostrum is a slender, sharp-pointed spine; distal half slightly curved upward and usually unarmed, basal half armed

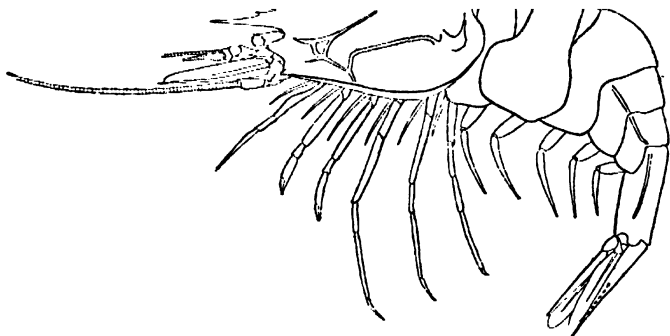


FIG. 8. *Hymenodora frontalis*. ♀ (× about 2). Station 3308.

with from 3 to 6 small spines above, two or three of which are beyond the line of the orbit. Occasionally there is a single spine on the distal half. Orbit deep; a tiny spine tips the suborbital lobe. Antennal spine strong; from it a sharp carina runs back subparallel to the side margin quite to the posterior margin. Above this the branchial region bears a blunt ridge, chiefly longitudinal, but bent down at either end; a deep groove extends obliquely downward and backward from the orbital sinus nearly to the lower carina.

The eyes reach to the middle of the basal segment of the antennulæ; they are without pigment, and bear a slender, blunt spine close up to the cornea on the inner margin. The antennular peduncles are short, the segments diminishing successively in length; basal scale narrow-oval, as seen from above; upper flagellum very thick at base. Antennal scale lanceolate, outer margin nearly straight, tipped with a small spine; peduncle very stout, attaining the end of the first antennular segment.

The outer maxillipeds do not reach the end of the antennal scale; the first pair of feet reach to the middle of the scale; the second pair extend not quite so far, and are more slender; the third pair reach nearly to or beyond the end of the scale; the fifth pair to the end of the antennal peduncle. The meral and propodal joints of the last three pairs are furnished with fine setæ.

Abdomen devoid of a median carina or median spines; the sixth segment is two and a half times as long as the fifth, and between three fourths and four fifths as long as the telson. The telson is about as long as the outer branch, longer than the inner branch of the swimmeret; it is armed with 7 to 9 spinules on either side and 4 long spines at the end. Eggs few and very large, the greatest diameter equaling the length of the fifth abdominal segment.

Dimensions.—Male, length of carapace and rostrum 19 mm., of rostrum 6.5 mm., of abdomen 32.5 mm.

Distribution.—From Bering Sea to off Monterey Bay, California, and Kamchatka; 322 to 1771 fathoms.

Taken at the following stations of the *Albatross*:

North of Rat Islands, Aleutians, 850 fathoms, station 3784.

Southwest of Pribilof Islands, 1625, 1771 fathoms, stations 3308, 3603.

North of Islands of Four Mountains, 1033 fathoms, station 3307.

South of Pribilof Islands, 1401 fathoms, station 3604.

West of Unalaska (type locality), 322 fathoms, station 3327.

North of Unalaska, 399 fathoms, station 3329.

Southeast of Chirikof Island, 695 fathoms, station 3340.

East of Prince of Wales Island, 1569 fathoms, station 2859.

Off Queen Charlotte Islands, British Columbia, 1588 fathoms, station 3342.

Off Destruction Island, Washington, 516 fathoms, station 3343.

Off Sea Lion Rock, Washington, 636–877 fathoms, stations 3070, 3071, 3074, 3075.

Off Monterey Bay, California, 418 fathoms, station 3127.

Off Copper Island, Kamchatka, 1567 fathoms, station 3783.

Relations.—The rostrum of this species approaches that of *H. rostrata* Bate, but is considerably longer; the pleon is like that of *H. glacialis* (Buchholz), *H. glauca* Bate, and *H. mollicutis* Bate in being without median carina and spines.

Family *PALÆMONIDÆ*.

Genus *Palæmon* Fabricius.

PALÆMON RITTERI Holmes.

In this species either one or two of the seven or eight dorsal teeth are situated behind the rostrum. Three ventral teeth.

Distribution.—From San Diego, California (type locality), to Gulf of California. Bay of St. Elena, Ecuador (Nobili). Specimens are in the National Museum from San Bartolomé Bay, Magdalena Bay, and La Paz Harbor, Lower California, and Carmen Island, in the Gulf of California; all of these were collected by the *Albatross*.

PALÆMONETES KADIAKENSIS Rathbun.

Palæmonetes kadiakensis RATHBUN, Proc. U. S. Nat. Mus., XXIV, 903, 1902.

Rostrum about as long as the carapace; it may be a little longer or a little shorter; nearly horizontal, very slightly upcurved, dorsally 6- or

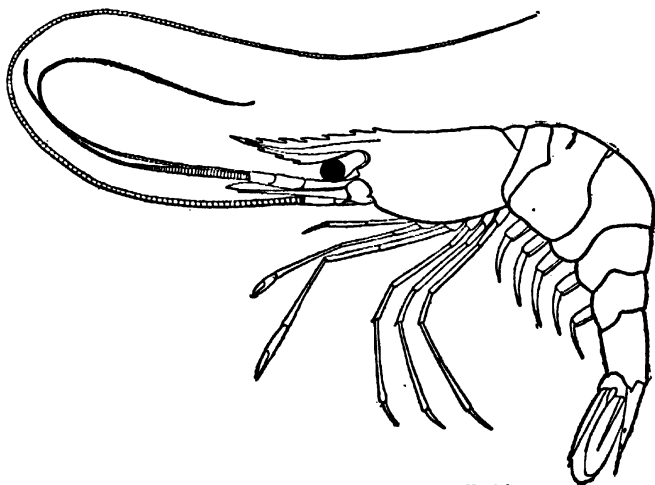


FIG. 9. *Palæmonetes kadiakensis*. ♀ (× 28). Kadiak.

7-serrate, one tooth behind the orbit, ventrally 2- or 3-serrate. Sub-orbital angle rounded, a spine just below it, also an antennal spine; antero-lateral angle rounded.

Eye wider than the stalk, light-colored in alcohol, a small black ocellus above near its margin. Antennular peduncle reaches about four fifths the length of antennal scale, basal joint the longest, having an outer scale which projects along one third of the second joint, and is tipped at its outer distal angle with a small spine. The outer filament of the outer flagellum is over half as long as the body; the inner filament is very short, equaling in length the last segment of the peduncle; inner flagellum about three fourths as long as outer.

Antennal scale as long or nearly as long as the carapace, oblong, the blade projecting considerably beyond the scale; preceding segment armed with a small spine at the outer base of the scale; peduncle not quite reaching end of first antennular segment; flagellum one and a third times the length of the body.

Outer maxillipeds very slender, reaching when extended only a small bit beyond the antennal peduncle. Feet of first pair reaching nearly to end of scale, carpus longer than merus, enlarged distally, and more than twice as long as propodus, fingers subequal in length to palm and covered with hair. Feet of second pair reaching beyond scale by half the length of propodus; carpus one and a half times merus, propodus three fourths length of carpus and no wider than in the first pair; fingers shorter than palm. The third to fifth pairs of feet increase successively in length by about half the length of the dactyli; the fourth pair reaches just to the end of the scale; dactyli slender and contained about three times in their propodi, which are sparingly spinulose.

Sixth abdominal segment twice as long as fifth, and nearly as long as the telson. Swimmerets longer than the telson, the outer branch longer than the inner.

Dimensions.—Length of ♀ 39 mm., length of carapace and rostrum 15 mm., of rostrum 7 mm.

Type locality.—Kadiak Island, Alaska, under stones at low water; William J. Fisher, collector.

The abdomen is much longer than in *P. vulgaris* Say of the Atlantic coast of North America, the sixth segment being one third again as long as in *P. vulgaris* with equal carapace; the rostral teeth are fewer, the acicle larger, the chelipeds of the second pair more slender. From *P. varians* Leach it differs in its longer rostrum, shorter feet of the second pair, in which the relative length of the segments also is quite different.

Genus *Urocaris* Stimpson.

UROCARIS INFRASPINIS Rathbun.

Urocaris infraspinis RATHBUN, Proc. U. S. Nat. Mus., XXIV, 903, 1902.

Closely allied to *U. longicaudata* Stimpson of the West Indian region.

Carapace and rostrum equal in length to the first three segments and half of the fourth segment of the abdomen. Rostrum not reaching end of second antennular segment, convex above, armed with 5 to 7 teeth above, 1 or 2 small teeth below near tip, tip acuminate; behind the rostrum a median gastric spine. Suborbital angle blunt. Antennal and hepatic spines of good size. Eyes two thirds as long as first antennular

segment, a minute black ocellus above and toward the outside, and beyond the limit of the cornea.

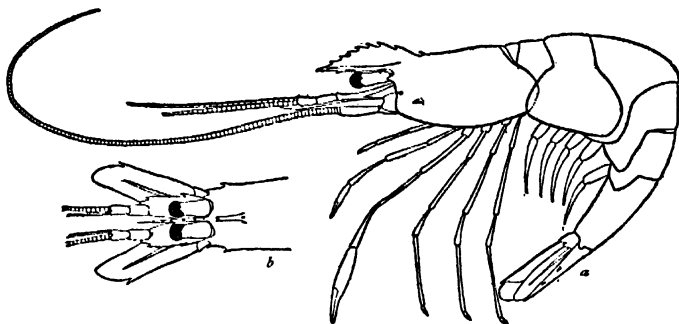


FIG. 10. *Urocaris infraspinis*. ♀ ($\times 3\frac{1}{2}$). Locality unknown. a. Side. b. Dorsal view of anterior portion.

Antennular peduncle nearly as long as carapace, exclusive of rostrum; first segment broad, its thin outer margin armed with a spine on the basal portion and another at the extremity; the inner angle of the lateral expansion is advanced beyond the articulation of the second joint; second and third segments subequal and together nearly equal to the first. The acicle is oblong, extremity oblique, produced at inner angle away beyond outer spine, which is in line with end of antennular peduncle. The antennal peduncle scarcely reaches end of first antennular segment; flagellum as long as body.

The outer maxillipeds extend to the middle of the last joint of the antennal peduncle. The first pair of feet reach the spine of the acicle; merus, carpus, and propodus subequal, palm and fingers subequal. The second pair of feet are as long as the distance from the end of the rostrum to the posterior end of the first abdominal somite; the ischium, merus, and carpus subequal, palm a little shorter, swollen; fingers nearly as long as palm. Last three pairs of feet reaching about to end of acicle; dactyli short, with a slender spine on the under side.

Abdomen geniculated at the third segment. Posterior margin of all the segments truncate. Sixth segment shorter than carapace (rostrum excluded), less than twice as long as fifth segment, and a little longer than the telson. Telson with two pairs of lateral spines, the outer uropods much longer than the telson, the inner uropods intermediate in length between the outer pair and the telson.

Dimensions.—Length of carapace and rostrum of ovigerous ♀ 6 mm., of rostrum 2.5 mm., of abdomen 15 mm.

Type locality.—Gulf of California, in Concepcion Bay, Lower Calif., two ♀ (*Albatross*).

Distribution.—Also taken at San Diego Bay, California, 3 fathoms (*Albatross* station 3567); Gulf of California, off San Josef Island, Lower California, 8 fathoms, station 3006; Guaymas, Mexico, inner harbor (P. L. Jouy, collector). One lot without label was associated with *Crangon nigromaculata* Lockington.

Relations.—This species, while having the general appearance of *U. longicaudata*, is markedly different: *U. longicaudata* has no antennal spine on the carapace; *U. infraspinis* has a distinct ocellus outside the cornea, *U. longicaudata* has not; in *U. infraspinis* the palm and fingers of the first pair are subequal; in *U. longicaudata* the palm is longer than the fingers; in *U. infraspinis* the carpus of the second pair is subequal to the merus, the palm is a little shorter, and the fingers still shorter; in *U. longicaudata* the carpus, palm, and fingers are subequal to one another and shorter than the merus; in our species the sixth abdominal somite is shorter than the carapace, and less than twice as long as the fifth; in *U. longicaudata* the sixth segment is as long as the carapace (rostrum excluded) and twice as long as the fifth.

Family PONTONIIDÆ.

Genus Pontonia Latreille.

PONTONIA CALIFORNIENSIS Rathbun.

Pontonia californiensis RATHBUN, Proc. U. S. Nat. Mus., xxiv, 902, 1902.

The carapace and rostrum exceed in length the first six segments of the abdomen. Rostrum more than one third the length of the remainder of the carapace, very narrow throughout, deflexed, reaching to the middle of the second segment of the antennular peduncle. A tooth on the anterior margin just above the base of the antenna. The eyes reach to the middle of the first antennular segment. The lateral expansion of this segment is broad behind and narrow in front, terminating in a short spine at the anterior angle; second segment one and a half times as long as third, both together half as long as first. Scale about two fifths as long as carapace, scarcely exceeding the antennular peduncle, the spine of the scale about as produced as the blade. Antennal peduncle reaching to end of scale.

Feet of first pair extending beyond the scale by the length of the propodus and nearly the whole of the carpus; merus and carpus subequal and each twice the ischium; propodus a little shorter than carpus; palm

and fingers subequal. The right foot of the second pair is missing; the left has a short, stout merus, carpus cup-shaped, with an inner distal tubercle, and a tubercle near the middle of the distal margin; palm and fingers subequal in length, palm two thirds as broad as long, inner edge marginate, fingers gaping, prehensile edges denticulate, fringed with long hair. Dactyli of last three pairs of feet with a sub-terminal and a terminal spine.

The telson is twice as long as the preceding segment, and has two pairs of long lateral appressed spines inserted on the anterior half.

The outer uropod is as long as the telson, the inner uropod a little longer.

Dimensions.—Length of carapace and rostrum 6.7 mm., of rostrum 1.8 mm., of abdomen 9 mm.

Type locality.—Off Santa Cruz Island, Calif., 30 fathoms (*Albatross* station 2945), one female.

This is the only *Pontonia* described from the west coast of North America,

the *P. margarita* of Smith being a *Conchodytes*.

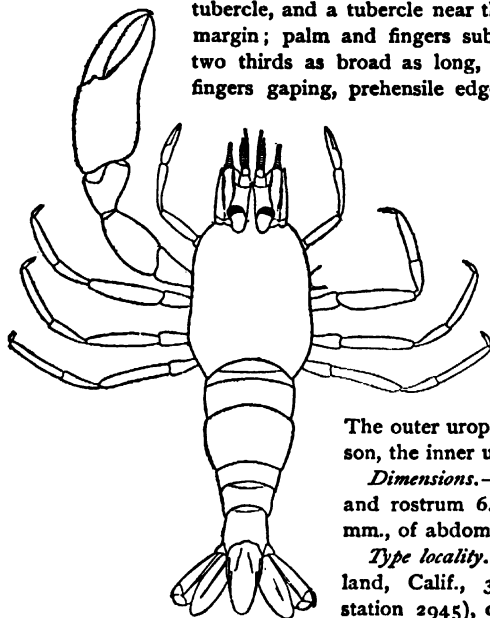


FIG. 11. *Pontonia californiensis* ($\times 47$). Station 2945.

Genus *Periclimenes* Costa.

PERICLIMENES TENUIPES (Holmes).

Anchista tenuipes HOLMES, Occas. Papers Calif. Acad. Sci., VII, 216, 1900.

Not *P. tenuipes* Borradaile, which may be called *P. borradalei*, nom. nov.

Distribution.—From Santa Catalina Island, California (Holmes), to Gulf of California. The *Albatross* collected specimens at

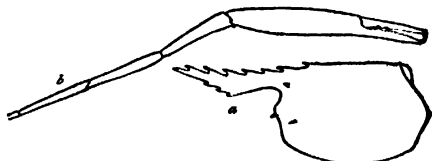


FIG. 12. *Periclimenes tenuipes* ($\times 4$). Concepcion Bay. a. Carapace. b. Foot of second pair.

Concepcion Bay, Lower California, and at stations 2824 and 2825 in the Gulf of California, 7 and 8 fathoms.

They agree with Dr. Holmes's description, except that the fingers of the second pair of feet are only a little over half as long as the palm and the postero-lateral angle of the sixth abdominal segment is subacute.

Family *PANDALIDÆ*.

Genus *Pandalus* Leach.

KEY TO THE SPECIES OF *PANDALUS*.

- A. Third segment of abdomen in part compressed and carinated, the carina forming a more or less well defined lobe or spine in front of the posterior margin.
 - B. Third and fourth segments of abdomen armed with a median spine on posterior margin *borealis*.
 - B'. Third and fourth segments of abdomen without median spine on posterior margin.
 - C. Rostrum unarmed on distal half of superior margin . . *goniurus*.
 - C'. Rostrum with spines on distal half of superior margin . *jordani*.
- A'. Third segment of abdomen not compressed and carinated, and without a median lobe or spine in front of posterior margin.
 - B. Dorsal spines not reaching behind middle of carapace.
 - C. Sixth abdominal segment more than twice as long as wide.
 - D. Carapace and abdomen covered with short transverse rugose lines *leptocerus*.
 - D'. Carapace and abdomen smooth *montagui tridens*.
 - C'. Sixth abdominal segment less than twice as long as wide *platyceros*.
 - B'. Dorsal spines extending behind middle of carapace.
 - C. Dorsal spines more than 15 (17-21) *hypsinotus*.
 - C'. Dorsal spines less than 15.
 - D. Rostrum one and a half or more than one and a half times as long as carapace *gurneyi*.
 - D'. Rostrum less than one and a half times as long as carapace.
 - E. Antennal scale very narrow, the terminal half of the blade narrower than the adjacent thickened portion *stenolepis*.
 - E'. Antennal scale of moderate width, the terminal half of the blade not narrower than the adjacent thickened portion *danae*.

PANDALUS BOREALIS Kröyer.

Pandalus borealis KRÖYER, Naturh. Tidsskrift, II, 254, 1838; (2) I, 461, 1845; in Gaimard's Voyage en Scandinavie, en Laponie, etc., pl. VI, fig. 2. STIMPSON, Jour. Boston Soc. Nat. Hist., VI, 501 [61], 1857; Ann. Lyc. Nat. Hist. N. Y., x, 128, 1871.—SMITH, Trans. Conn. Acad. Arts Sci., v, 86, 1879.—BIRULA, Ann. Mus. Zool. Acad. Impér. Sci. St. Pétersbourg, 1897, p. 420 [16]; 1899, pp. 22 [3], 28 [9].

Surface of body smooth and naked. Rostrum about one and three fourths times as long as the carapace, slightly arched above the eyes, terminal half slightly ascending; slender, armed with 12 to 16 teeth above (including 3 or 4 on the carapace), of which all but the one, two, or three most anterior are movable, and 6 to 9 distant immovable teeth below, diminishing in size anteriorly; tip bifid, upper tooth the smaller. The posterior of the dorsal spines lies between the middle and the anterior third of the carapace; the anterior is situated at least as far forward as the distal third of the rostrum.

Antennal spine strong, pterygostomian slender, feeble. Eyes large, pyriform.

Peduncle of antennulæ reaching to the middle of antennal scale; second and third joints subequal; outer flagellum twice as long as carapace, its basal third thickened; inner flagellum longer than outer. Antennal scale seven eighths as long as carapace, the blade obliquely rounded at the end and exceeding the spine.

Antennal peduncle extending to end of second joint of antennular peduncle; flagellum longer than the body. Outer maxillipeds reaching to distal fourth or nearly to end of scale. First pair of feet shorter, but overreaching middle of scale. Of the second pair of feet, the right is one and a half or one and two thirds times the length of carapace; its carpus is divided into 25 to 27 segments: the left is slenderer and one fourth or one third again as long as the right; its carpus has about 58 segments. The third, fourth, and fifth diminish slightly in length in the order named, the third pair overreaching the scale by at least the length of its dactyl. The dactyli are slender, and are contained in the propodi from three to three and a half times.

The terminal portion of the third segment of the abdomen is compressed and carinated; a sharp spine or lobe pointing backward is situated at the posterior third of the segment; posterior margin produced backward in an acute lobe terminating in a small spine. A similar spine terminates the truncate fourth segment. Sixth segment elongate, about twice as long as fifth; seventh armed with 7 to 10 aculei on each side, and 4 terminal, of which the submedian pair are slenderer and about half as long as the outer pair.

Dimensions.—Ovigerous female, length 13.5 cm., length of carapace and rostrum 64 mm., of rostrum 41 mm.

Females carrying eggs were taken August 5th and 6th in Bering Sea (stations 3528, 3530).

Distribution.—Circumpolar. Bering Sea and North Pacific southward on the American coast to Columbia River; 29½ to 350 fathoms.

Okhotsk Sea (Brandt). On Atlantic coast of North America from Greenland southward to Massachusetts Bay, 40 to 160 fathoms. Scandinavia.

Juneau, Alaska, 50 fathoms (Harriman Expedition).

Taken by the *Albatross* at the following localities:

Bering Sea, southwest of St. Matthew Island, 59-77 fathoms, stations 3530, 3532.

Bering Sea, off Pribilof Islands, 39-184 fathoms, stations 3309, 3439-3442, 3482-3489, 3491-3497, 3500, 3511, 3523, 3524, 3526-3528, 3533-3536, 3538, 3539, 3544, 3553-3556, 3559-3561, 3602, 3605, 3606, 3609, 3610.

Between Bristol Bay and Pribilof Islands, 29½-36 fathoms, stations 3252, 3253, 3306.

North of Rat Islands, 270 fathoms, station 3785.

North of Umnak Island, 49 fathoms, station 3537.

North of Unalaska, 61-350 fathoms, stations 3226 (1 quart rejected), 3316 (309 fathoms, 1 specimen), 3317, 3318, 3331 (350 fathoms, 1 specimen).

Chernofski Harbor, Unalaska, 109 fathoms, station 3324.

Pumicestone Bay, Unalaska, 54 fathoms, station 3321.

Iliuliuk Harbor, Unalaska, 50-93 fathoms, stations 3310, 3311, 3313, 3314 (1 quart rejected), 3334-3336.

Off Akutan Island, 56-91 fathoms, stations 2841, 2842, 3548, 3549.

Off south entrance to Akutan Pass, 45 fathoms, station 2843.

Off Aektok Island, 54 fathoms, station 2844.

Northwest of Unimak Island, 41-121 fathoms, stations 3224 (½ peck discarded), 3225 (2 bushels rejected), 3257 (1 peck rejected), 3258, 3259, 3263 (2 quarts rejected).

Unimak Pass, 34 fathoms, station 3220.

North of Unimak Island, 49 fathoms, stations 3256, 3542.

Davidson Bank, 42 fathoms, station 2845.

South of Unimak Island, 61 fathoms, station 3216.

Off Kudobin Islands, 36-53 fathoms, stations 3278, 3279 (1 pint rejected), 3280, 3282, 3283.

Shumagins, 48-110 fathoms, stations 2847, 2848 (abundant), 2849, 2852.

South of Trinity Islands, 67 fathoms, station 3341.

Off Sitkalidak Island, 60 to 69 fathoms, stations 2854, 2855.

Gulf of Georgia, British Columbia, 67 fathoms, station 2863.

Strait of Fuca, 40-152 fathoms, stations 3445, 3446, 3451, 3453, 3455, 3458-3462, 3464, 3465, 3596, 3597.

Washington Sound, Strait of Fuca, 48 fathoms, station 2864 (very numerous).

Puget Sound, 82 fathoms, station 3067.

Admiralty Inlet, Puget Sound, 40 fathoms, station 2865.

Off Cape Flattery, Washington, 38 fathoms, station 2872.

Off Columbia River, 68 fathoms, station 2882.

Station 3675 (locality not given), 110 fathoms.

Unalaska (Brandt).

PANDALUS GONIURUS Stimpson.

Plate 1, fig. 3.

Pandalus goniurus STIMPSON, Proc. Acad. Nat. Sci. Phila., XII, 36 [105], 1860.

Pandalus dapifer MURDOCH, Proc. U. S. Nat. Mus., VII, 519, 1884; Marine Invertebrates, in Rept. International Exped. to Pt. Barrow, Alaska, 141, pl. 1, figs. 2-2c, 1885. — RATHBUN, The Fur Seals and Fur-Seal Islands of the North Pacific Ocean, Pt. III, 557, 1899.

Allied to *P. borealis*. Rostrum one and a half times as long as carapace, terminal half ascending, posterior half horizontal; armed above with 8 to 9 movable spines, including 3 on carapace; the anterior spine behind middle of rostrum, the posterior spine in front of middle of carapace; lower limb deeper in front of eye than in *P. borealis*, and armed with 6 or 7 immovable spines; tip bifid, upper tooth smaller.

Antennular flagella shorter than in *P. borealis*, the inner and longer one being one and a half times as long as carapace. The spine at the antero-lateral angle of the antennal scale extends nearly to the end of the blade. Antennal peduncle falls a little short of end of second joint of antennular peduncle; flagellum nearly as long as body.

Carpus of right foot of second pair divided into 18 to 20 articles; the left foot nearly one and a half times the right and with 51 to 54 articles.

The third segment of the abdomen possesses a lobe as in *P. borealis*, but the lobe is blunt, not sharp; the median line in front of the lobe is nearly horizontal; the posterior margin is only slightly produced backwards at its middle; and it, as well as the fourth segment, is devoid of a median spine. The sixth segment is a little shorter than in *P. borealis*; seventh segment bears 5 to 6 lateral spinules.

Otherwise as in *P. borealis*.

Sometimes occurs with *P. borealis*, though an inhabitant of shallower water. They are easily distinguished by the presence of spines on the anterior half of the top of the rostrum in *P. borealis* and the absence of the same in *P. goniurus*; and by the blunt rather than sharp lobe on the third abdominal segment in the last-named species, as well as the absence of median spines from the posterior margin of the third and fourth segments.

Dimensions.—Large female: Length 90 mm., length of carapace and rostrum 41.5 mm., of rostrum 25.2 mm.

Distribution.—Ranges from the Arctic coast of Alaska southward to Okhotsk Sea on the one side and Puget Sound on the other, in 3 to 100 fathoms. Its occurrence below 50 fathoms is exceptional.

Taken by the *Albatross* at the following localities:

- Bering Sea, off St. Matthew Island and Pribilof Islands, 21-59 fathoms, stations 3439, 3513, 3514, 3523, 3524, 3531, 3536, 3611.
- Off Nunivak Island, 17-24 fathoms, stations 3516, 3517.
- Off Cape Newenham, 17 fathoms, station 3247 (1 gallon rejected).
- Off Hagemeister Island, $4\frac{1}{2}$ -17 $\frac{1}{2}$ fathoms, stations 3243, 3244, 3246.
- Kulukak Bay, 11-14 $\frac{1}{2}$ fathoms, stations 3240-3242 ($\frac{1}{2}$ peck rejected).
- Off Kulukak Bay, 15-17 fathoms, stations 3300, 3301 (2 quarts rejected).
- Bristol Bay, 5-18 fathoms, stations 3233, 3234, 3236, 3238.
- Off Bristol Bay, 25 $\frac{1}{2}$ -36 fathoms, stations 3251-3253, 3302 (1 quart rejected), 3303, 3306, 3501.
- Off Cape Menshikof, 24 fathoms, station 3296.
- Off Cape Strogonof, 26-32 fathoms, stations 3291-3294.
- Herendeen Bay.
- Off Cape Seniavin, 35-37 fathoms, stations 3285, 3286.
- Off Kudobin Islands, 36-39 fathoms, stations 3281, 3283 (1 pint rejected).
- Off Cape Leontovich, 18-22 fathoms, stations 3275, 3276.
- Off Amak Island, 19-39 fathoms, stations 3273, 3274.
- Off Unimak Island, 32-34 fathoms, stations 3256, 3259, 3267.
- Pumicestone Bay, Unalaska, 54 fathoms, station 3321.
- Gulf of Georgia, British Columbia, 67 fathoms, station 2863.
- Strait of Fuca, 48-53 fathoms, stations 3460, 3465.
- Washington Sound, Strait of Fuca, 48 fathoms, station 2864.
- Bellingham Bay, Washington, 11 fathoms, station 3612.
- Admiralty Inlet, Puget Sound, 40 fathoms, station 2865.
- Off Cape Nalacheff, Kamchatka, 39-42 fathoms, station 3781.
- Avacha Bay, Kamchatka, 16 fathoms, station 3642.
- Southeast coast of Kamchatka, 96-100 fathoms, stations 3643, 3644.
- Off Robben Island, Okhotsk Sea, 18-28 fathoms, stations 3646, 3647, 3649, 3650.

Collected by W. H. Dall:

- Off Cape Sabine, 13 fathoms.
- Hagemeister Strait, 8-15 fathoms.
- Iliuliuk Harbor and Captains Harbor, Unalaska, 3-15 fathoms.
- Shores of Amaknak Island.
- Popof Strait, Shumagin Islands.
- Chugachik Bay, Cook Inlet, 20-60 fathoms.

Other specimens in the National Museum are from:

- Ten miles west of Point Franklin, Alaska, 13 $\frac{1}{2}$ fathoms (Point Barrow Expedition, types of *P. dapifer* Murdoch).
- Bering Strait (Dr. Robert White).
- Lat. 66° 12' N., long. 168° 54' W. (Lieutenant G. M. Stoney, U. S. N.).
- Lat. 63° 50' N., long. 167° 21' W., 17 fathoms (Lieutenant G. M. Stoney, U. S. N.).
- Off mouth Yukon, 3 $\frac{1}{2}$ fathoms (E. W. Nelson).
- Bering Island (N. Grebnitzky); some specimens found in stomach of *Gadus macrocephalus*.
- Petropavlovsk, Kamchatka (L. Stejneger).
- Avacha Bay (Stimpson).

PANDALUS JORDANI Rathbun.

Plate II, fig. 3.

Pandalus jordani RATHBUN, Proc. U. S. Nat. Mus., XXIV, 900, 1902.

Surface smooth and shining. Rostrum about one and three fourths times as long as carapace, slightly arched above the eyes, terminal two thirds ascending; slender, armed with 14 to 17 spines above, including 4 on the carapace; distal three immovable, others movable; closer together above the eye; 7 to 10 immovable spines below, extending nearer to tip than superior spines; tip acuminate; the posterior of the dorsal spines lies between the middle and the anterior third of the carapace.

Antennal spine strong; pterygostomian small, slender. Eyes large, pyriform.

Peduncle of antennulæ reaching to middle of antennal scale; second and third joints subequal; flagella subequal, one and a half times as long as carapace, thickened portion of outer flagellum extending half its length beyond the antennal scale. Scale three fourths to four fifths as long as carapace, extremity of blade broadly rounded, and equally produced with the spine; antennal peduncle reaching to end of second segment of antennular peduncle; flagellum one fourth longer than body.

Outer maxillipeds slender, not reaching end of acicle. First pair of feet a little shorter; of the second pair, the right foot extends about to end of scale, the left may be half again as long; the right carpus has 19 to 22 segments, the left 58 to 63 segments. The last three pairs of feet diminish a little in length successively, the third pair exceeding the scale slightly; their dactyli are elongate, and are contained from two and a half to two and four fifths times in their propodi.

The third segment of the abdomen is compressed and its posterior half carinated, the carina interrupted by a slight lobe at the posterior third of the segment; this lobe is of varying size, at no time strong, and having a tendency to disappear in large specimens, where it may occur only as a slight unevenness in the curve seen in profile; posterior margin well produced backward, rounded, unarmed; fourth segment with posterior margin truncate, entire; sixth about twice as long as fifth and three fourths as long as seventh, which has 10 to 13 lateral aculei on each side.

Females bearing eggs taken in January and February off southern California.

Dimensions.—Ovigerous female, length 124.5 mm., length of carapace and rostrum 59.5 mm., of rostrum 38 mm.

Distribution.—From Unalaska to southern California, 35 to 178 fathoms:

Monterey and San Pedro, California (D. S. Jordan, 1880).

Taken by the *Albatross* at the following localities:

Iliuliuk Harbor, Unalaska, 85, 68 fathoms, station 3311 (1 specimen), station 3313 (1 specimen).

Gulf of Georgia, British Columbia, 67 fathoms, station 2863 (1 specimen).

Strait of Fuca, 98–152 fathoms, stations 3447–3456, 3458, 3459, 3461.

Off Strait of Fuca, 142 fathoms, station 3457.

Flattery Bank, Washington, 77 fathoms, station 3673.

Off Tahwhit Head, Washington, 178 fathoms, station 3076.

Near Flattery Rocks, Washington, 171 fathoms, station 2866.

Off Grays Harbor, Washington, 48–58 fathoms, stations 2870, 3046 (abundant), 3047 (abundant), 3048.

Off Columbia River, 55–68 fathoms, stations 2882 (abundant), 3066.

Off Tillamook Rock, Oregon, 46 fathoms, station 3064.

Off False Tillamook, Oregon, 62 fathoms, station 3090.

Off Siletz Bay, Oregon, 77 fathoms, station 3059.

Off Heceta Bank, Oregon, 93 fathoms, station 3080.

Off Point Arena, California, 51 fathoms, station 3251.

Off Bodega Head, California, 167 fathoms, station 3170.

Off Tomales Point, California, 57 fathoms, station 3175.

Off Drake Bay, California, 35 fathoms, station 3155.

Monterey Bay, California, 56 and 68 fathoms, stations 3666, 3671.

San Luis Obispo Bay, California, 77 fathoms, station 3197.

Off Santa Cruz Island, California, 155 fathoms, station 2949 (type locality).

Southwest of San Nicholas Island, California, 158 fathoms, station 2898.

Distinguished from *P. borealis*, which has a similar rostrum, by the reduction of the abdominal lobe or hump, and the absence of posterior median spines on third and fourth segments.

PANDALUS MONTAGUI TRIDENS Rathbun.

Plate II, fig. 2.

? *Pandalus annulicornis* RICHTERS, Abh. Senck. Natur. Gesell., XIII, 405, 1884. Bering Sea, N. of Akutan Pass, 70 fath.; Plover Bay.

Pandalus montagui RATHBUN, The Fur Seals and Fur-Seal Islands of the North Pacific Ocean, Pt. III, 557, 1899.

Pandalus montagui tridens RATHBUN, Proc. U. S. Nat. Mus., XXIV, 901, 1902.

Distinguished from the three foregoing species by its non-carinated abdomen devoid of a hump. Rostrum slender, from one and a half to one and four fifths times the length of carapace. Dorsal spines 10 to 12 in

number, all movable, and situated, 3 to 5 on the carapace, and the remainder on the basal half of the rostrum. Posterior spine just in front of middle of carapace. Inferior spines 6 or 7, rigid. Distal two thirds of rostrum ascending; tip trifid.

Outer margin of acicle slightly arcuate, blade truncate at tip, spine stout, reaching to or beyond the end of blade.

The outer maxillipeds may fall short of or exceed the scale. Carpus of right foot of second pair divided into 20 to 28 segments, of left foot into about 74 segments.

Dactyli of last three pairs short, being contained from five and a half to seven and a half times in their propodi. Last pair reaching end of acicle or beyond.

No median spines on abdomen; third segment produced moderately backward at the middle, margin broadly rounded at that point. Lateral aculei of telson 5 to 7.

Dimensions.—Female, station 2842, length 104 mm., length of carapace and rostrum 48.5 mm., of rostrum 30.2 mm.

The largest specimen on the Pacific coast was taken off Point Arena, California, in 239 fathoms. It measures 110 mm. long, carapace and rostrum 53 mm., rostrum 34 mm.

Distribution.—From Bering Sea to Point Arena, California, 3–351 fathoms.

Taken by the *Albatross* at the following localities:

Off Pribilof Islands, 25–184 fathoms, stations 3482–3491, 3494, 3496, 3497, 3500, 3504, 3505, 3536, 3540, 3544, 3552, 3554, 3558–3561, 3602, 3605, 3611, 3637.

Off Rat Islands, Aleutian Islands, 55 fathoms, station 3599.

Off Unalaska, 59–351 fathoms, stations 3236, 3315, 3317, 3319, 3330, 3331.

Pumicestone Bay, Unalaska, 35–54 fathoms, stations 3321, 3322 (1 quart rejected at each station).

Iliuliuk Harbor, Unalaska, 85 fathoms, station 3311.

Off Akutan Island, 36–91 fathoms, stations 2842 (type locality, abundant), 3546, 3548.

Off south entrance to Akutan Pass, 45 fathoms, station 2843.

Northwest of Unimak Island, 43–70 fathoms, stations 3258, 3262.

Unimak Pass, 34–56 fathoms, stations 3220, 3222, 3223.

Northeast of Unimak Island, 38 fathoms, station 3265.

Davidson Bank, 42–43 fathoms, stations 2845, 3215.

South of Unimak Island, 42–61 fathoms, stations 3216, 3217.

Southwest and south of Sannak Islands, 38–44 fathoms, stations 2846, 3213, 3214 (abundant).

North of Amak Island, 39 fathoms, station 3273.

Off Kudobin Islands, 36–53 fathoms, stations 3279, 3281, 3282.

Shumagins, 21-69 fathoms, stations 2847, 2849-2852.
 Off Shumagin Bank, 138 fathoms, station 3339 (1 peck rejected).
 Off the Trinity Islands, 67-159 fathoms, stations 2853, 3341.
 Portlock Bank, 51-230 fathoms, stations 2856 (abundant), 2857, 2858.
 Off Queen Charlotte Sound, British Columbia, 204 fathoms, station 2861.
 Near Flattery Rocks, Washington, 171 fathoms, station 2866.
 Off Point Arena, California, 239 fathoms, station 3349.

Small specimens were collected by Dr. Dall at Bay of Islands, Adak, Nazan Bay, Atka, and Iliuliuk Harbor and Captains Harbor, Unalaska, in 3 to 80 fathoms.

Puget Sound (T. Kincaid).

Berg Bay, Glacier Bay (Harriman Expedition).

Juneau, 20 fathoms (Harriman Expedition).

I have separated this form from *P. montagui* Leach of the North Atlantic on account of its somewhat longer rostrum, which varies from one and a half to one and two thirds times the carapace, the dorsal spines terminating behind the middle of the rostrum, while in typical *P. montagui* the rostrum is from one and two fifths to one and a half times the carapace, and its dorsal spines reach to or in front of its middle. In *P. montagui* the tip is bifid; in the subspecies usually trifid.

PANDALUS LEPTOCERUS Smith.

Pandalus leptocerus SMITH, Proc. U. S. Nat. Mus., III, 437, 1881; Bull. Mus. Comp. Zool., x, 58, 1882; Rept. U. S. Commr. of Fish and Fisheries for 1882, 367 [23], pl. v, fig. 1, 1884.—A. MILNE EDWARDS, Recueil Planches Expéd. Travailleur, pl. xxii, 1883.

An elongate species. Surface of carapace and abdomen roughened with short and irregular transverse, punctate ridges, which give rise to very short, bristle-like hairs.

Rostrum from about one and a third to nearly twice as long as the rest of the carapace, and curved very slightly upward; armed above with 11 to 13 movable spines, of which one is near the tip and usually only two on the carapace proper, while a considerable space back of the terminal spine is unarmed; below 6 to 8 immovable spines. The posterior dorsal spine is considerably in front of the middle.

Outer maxillipeds provided with an exopod; the endopod falls short of the end of the antennal scale, and the first pair of feet are correspondingly shorter than the maxillipeds. Right leg of second pair reaches about to end of first pair; carpus has 5 segments, proximal half undivided, and followed by 3 subequal segments, each about as long as broad, together equal to terminal segment; chela about half as long as carpus. The left leg of second pair has 52 to 64 segments in the carpus; the

merus and distal end of ischium are also faintly segmented. The last three pairs of legs are very slender, and have slender, nearly cylindrical dactyli, which have only a few small spinules beneath near the base, and are contained between two and three times in their propodi.

Abdomen more slender than in *P. montagui tridens*. Otherwise as in that species.

Dimensions.—Female (off Cape Ann, Massachusetts), length 98 mm., carapace and rostrum 43.5 mm., rostrum 27.4 mm.

Distribution.—Very common on the Atlantic coast of America from Nova Scotia to Chesapeake Bay in 15 to 321 fathoms.

One specimen only has been taken in the Pacific, by the *Albatross*, off Shumagin Bank, Alaska, 138 fathoms, station 3339.

PANDALUS PLATYCEROS Brandt.

Pandalus platyceros BRANDT, in Middendorff's Reise in den äussersten Norden und Osten Sibiriens, Band II, Zool., Theil I, 123, 1851.—STIMPSON, Jour. Boston Soc. Nat. Hist., VI, 501 [61], 1857.

Pandalus pubescentulus DANA, Crust. U. S. Expl. Exped., I, 568, 1852; pl. XXXVI, fig. 8, 1855.—STIMPSON, Jour. Boston Soc. Nat. Hist., VI, 501 [61], 1857.—KINGSLEY, Bull. Essex Inst., X, 63, 1878.—SMITH, Rept. Prog. Geol. Survey Canada, 1878-79, B, p. 214.—HOLMES, Occas. Papers Calif. Acad. Sci., VII, 210, 1900.

Body stout. Carapace covered with a dense, short pubescence. Rostrum one and a half to one and two thirds times the carapace, provided with a broad entire laminar crest on each side. Median crest arising half-way back on the carapace, armed with 14 to 17 spines extending to middle of rostrum, the anterior 1 to 5 fixed, the rest movable; usually a solitary spine not far behind the acute tip; lower limb armed with 7 or 8 fixed spines, diminishing gradually in size; the basal tooth very large. Posterior part of rostrum deflexed, anterior half or two thirds ascending, tip above level of carapace. Antennal spine very strong; pterygostomian small, but well marked.

Eyes large, pyriform; cornea in alcohol light greenish; ocellus black.

Antennular peduncle reaching two fifths the length of acicle, second and third joints subequal; outer flagellum one half longer than carapace, its basal half thickened; inner flagellum a little longer; outer basal scale reaching nearly to end of first joint.

Antennal scale four fifths to seven eighths as long as carapace, oblong, extremity of blade subtruncate, slightly exceeded by the spine; peduncle reaching nearly to the middle of the third segment of antennular peduncle; flagellum stout at base, equaling or exceeding length of body.

Maxillipeds stout, reaching nearly or about to end of antennal scale; first pair of feet to middle of terminal joint of maxillipeds. Right leg of

second pair reaching to end of maxillipeds, carpus 8- to 9-jointed, the first joint as long as the next 5 or 6, which are subequal, and twice as long as the last joint; propodus about half as long as carpus; fingers two thirds as long as palm. Left leg of second pair two fifths again as long as right; carpus divided into 27 or 28 joints, the first and last joints about twice as long as the adjoining segment; intervening segments varying a little in size, but those of the distal half a little larger; propodus as long as last three segments of carpus; fingers three fourths as long as palm. Third to fifth legs stout, the third reaching about the length of its dactyl beyond the acicle, the fifth reaching to middle of acicle; dactyli contained from 4 to 6 times in their propodi.

Abdomen slightly more than twice as long as carapace, smooth, non-carinate; third segment very slightly produced backward in the middle; sixth segment short and stout, one and a half times as long as wide; seventh one and a half times as long as sixth, with six spinules on each side.

Dimensions.—Ovigerous female (station 3129), length 214 mm., length of carapace and rostrum 113 mm., of rostrum 68 mm.

Distribution.—Unalaska (Brandt) to off San Diego, California. Strait of Fuca at Dungeness, Washington (Dana). The specimens in the National Museum from north of the Strait of Fuca were found in shallow water, while in the Strait and along the coast of California the species occurs in considerable depths, from 48 to 266 fathoms.

Taken at the following localities by the *Albatross*:

Klinkwan, Prince of Wales Island, Alaska.

Karta Bay, Alaska.

Metlakatla, Annette Island, Alaska.

Mary Island, Alaska.

Otter Bay, Pender Island, British Columbia.

Port Angeles, Washington.

Strait of Fuca, 100-151 fathoms, stations 3445, 3449-3451, 3458.

Washington Sound, Strait of Fuca, 48 fathoms, station 2864.

Off Bodega Head, California, 167 fathoms, station 3170.

Off Farallone Islands, California, 191 fathoms, station 3161.

Off Point Ano Nuevo, 203 fathoms, station 3208.

Off Monterey Bay, 65-204 fathoms, stations 3125, 3129.

Off Point Carmel, 162 fathoms, station 3183.

Off Cape San Martin, 218 fathoms, station 3189.

Off Point Conception, 145 fathoms, station 2893.

Off Santa Cruz Island, 150-266 fathoms, stations 2946, 2948, 2949.

Off San Diego, 124 fathoms, station 2935.

Killisnoo, Alaska (Northern Trading Co.).

Lituya Bay, in stomach of halibut (W. H. Dall).

Hood Canal, near Union, Washington, 20 fathoms (R. W. Doane).

PANDALUS HYP SINOTUS Brandt.

Plate II, fig. 5.

Pandalus hypsinotus BRANDT, in Middendorff's Reise in den äussersten Norden und Osten Sibiriens, II, Zool., I, 125, 1851. Unalaska.

Body stout. Rostrum a little (one sixth or one seventh) longer than the carapace, which is strongly arched dorsally. The median crest reaches nearly to the posterior margin; the superior median spines are movable, occupy the anterior three fifths of the carapace, and extend an equal distance on the rostrum, in all numbering 17 to 22. The distal portion is strongly ascending and unarmed, except at the tip, which is oblique and armed with three immovable spines; the lower margin is furnished with 7 to 9 fixed spines, the posterior ones very large and hooked; lateral carinæ of moderate prominence. Antennal spine of moderate size, acuminate; pterygostomial spine small.

Eyes pyriform, nearly as broad as long; cornea in alcohol bluish; ocellus darker.

Antennular peduncle reaching not quite to the middle of the acicle; second joint a little longer than the third. Outer flagellum two thirds as long as carapace, the posterior five sixths thickened; inner flagellum about one fourth longer than outer; basal scale lobiform, not reaching end of eye.

Antennal scale about four fifths as long as carapace, oblong, extremity obliquely subtruncate, spine very slightly longer. Peduncle reaching to end of second segment of antennular peduncle; flagellum nearly as long as the body.

Maxillipeds in large specimens reaching a little in advance of the acicle; first pair of feet nearly to end of acicle. Right leg of second pair reaching about to the end of the rostrum, carpus with 19 or 20 segments, the first and last of which are about equal to the three adjoining segments; propodus as long as the last four segments of the carpus, fingers two thirds the length of palm. Left leg of second pair half again as long as right; carpus composed of about 60 segments, the first and last subequal to the three adjoining segments; propodus a little longer than the last three segments of the carpus; fingers nearly as long as palm. The merus and the ischium of the second pair are also more or less segmented. The third pair of legs extends beyond the acicle by the length of the dactylus and half or more of the propodus; the fifth pair reaches beyond the middle of the acicle. Dactyli of last three pairs, in the female, contained from two and one fourth to four times in their propodi. In the male the propodi of the third and fourth pairs are a little shorter, are recurved (in the third pair strongly so), and are narrowed at the extremity.

Abdomen two and a third times as long as carapace, smooth, non-carinate, third segment very slightly produced backward in the middle; sixth segment twice as long as wide; seventh one and a half times as long as sixth, with six spinules on each side.

Dimensions.—Ovigerous female (Herendeen Bay), length 133 mm., length of carapace and rostrum 61 mm., of rostrum 31 mm.

Distribution.—From Bering Sea to Strait of Fuca and Kurile Islands, 3 to 20 fathoms.

Unalaska (Brandt).

Specimens have been examined from the following localities:

Cape Etolin, Nunivak, 8 fathoms; Hagemeister Island, 8 to 15 fathoms; Nazan Bay, Atka, 10 to 16 fathoms; Unalaska, 3 to 6 fathoms; Iliuliuk Harbor, Unalaska, 3 to 10 fathoms; Port Levashef, Unalaska; Popof Strait, Shumagins, 6 fathoms; Shahaska Cove, Kadiak; Chugachik Bay, Cook Inlet, between 20 and 60 fathoms; Sitka Harbor, 15 fathoms (W. H. Dall).

St. Michael, Norton Sound (E. W. Nelson).

Herendeen Bay, Alaska, fine specimens, abundant (*Albatross*).

Kadiak, dredged (W. R. Coc, Harriman Expedition), "very bright colored."

Port Angeles, Washington (*Albatross*).

Portage Bay, Alaska (Lieutenant H. E. Nichols, U. S. N.).

Bering Island (L. Stejneger and N. Grebnitzky).

Petropavlovsk, Kamchatka (L. Stejneger).

Rakovaya Bay, Avacha Bay, Kamchatka (*Albatross*).

Off Iturup Island, Kurile Islands, 18 fathoms (*Albatross* station 3653).

PANDALUS DANÆ Stimpson.

Pandalus danæ STIMPSON, Proc. Boston Soc. Nat. Hist., VI, 87, 1857;

Jour. Boston Soc. Nat. Hist., VI, 502 [62], pl. XXI, figs. 6, 7, 1857.

Opposite Fort Townsend in Puget Sound.

Pandalus franciscorum KINGSLEY, Proc. Acad. Nat. Sci. Phila., 1878, 94. San Francisco.

A rather stout species. Surface finely pitted. Rostrum a little longer than the carapace (from one fifth to one eighth longer), distal two thirds directed obliquely upward. Median dorsal spines 10 to 12, movable, about half of them on the carapace, the posterior spine a little behind the middle; terminal half of rostrum unarmed above, apex trifid, lower margin 6- to 8-spined, the spines diminishing anteriorly; lateral carinæ moderately prominent. Antennal spine acuminate; pterygostomial spine small, but well marked.

Antennular peduncle reaching about half the length of acicle, last two joints subequal; outer flagellum about seven tenths length of carapace,

basal three fourths thickened; inner flagellum one fourth or one third longer than outer; basal scale reaching only to middle of first segment, its distal outer angle almost a right angle.

Antennal scale from three fourths to five sixths as long as carapace, tapering to the extremity, the laminar part of which is rounded, and much exceeded by the spine; peduncle reaching to end of second segment of antennular peduncle; flagellum equaling or exceeding the length of the body.

Maxillipeds reaching nearly to end of acicle; first pair of feet to middle of terminal joint of maxilliped. The right leg of the second pair may slightly exceed or fall short of the tip of the rostrum; merus slightly annulated; carpus with from 18 to 21 joints, those of the proximal half very indistinctly marked, the last joint as long as the two preceding; propodus the length of the last four carpal segments, palm longer than digits. Left leg of second pair one third or nearly half again as long as right leg; merus and distal portion of ischium faintly annulated; about 60 carpal segments, hand and fingers much as in the right leg. Third leg of female reaching beyond the rostrum by one third or one fourth the length of the propodus. Fourth leg reaches one third or one half the length of the propodus of the third pair, while the fifth may reach beyond

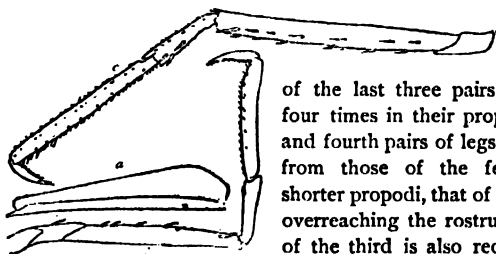


FIG. 13. *Pandulus danae* (X 2). Station 2865. a. Acicle. b. Third leg of ♂. c. Third leg of ♀.

the middle of the propodus of the fourth. Dactyli

of the last three pairs contained about four times in their propodi. The third and fourth pairs of legs of the male differ from those of the female in having shorter propodi, that of the third scarcely overreaching the rostrum; the propodus of the third is also recurved instead of straight and narrow at the extremity, forming an oblique margin against which

the dactylus folds; the dactyli of the last three pairs are contained about three times in their respective propodi.

Abdomen two and a half times as long as carapace, smooth, non-carinate, third segment very slightly produced backward in the middle; sixth segment one and two thirds as long as wide; seventh one and a half times as long as sixth, and with six spinules on each side.

Dimensions.—Adult female (San Francisco market), length 110 mm., length of carapace and rostrum 50 mm., of rostrum 26.5 mm.

Distribution.—From Sitka, Alaska, to San Francisco, California.

Specimens have been examined from:

Sitka, Alaska, 10 fathoms (Harriman Expedition).
 Ward Cove, Revillagigedo Island, Alaska (Dr. T. H. Streets, U. S. N.).
 Off Cape Beale, Vancouver Island, 24 fathoms (*Albatross*, station 2881).
 Otter Bay, Pender Island, British Columbia (*Albatross*).
 Strait of Fuca, 40-97 fathoms (*Albatross*, stations 3443, 3462, 3464, 3465).
 Admiralty Inlet, Puget Sound, 40 fathoms (*Albatross*, station 2865).
 Puget Sound (T. Kincaid).
 Port Angeles and Port Townsend, Washington (*Albatross*).
 Port Orchard, Washington (O. B. Johnson).
 San Francisco, California (D. S. Jordan).
 San Francisco market (R. E. C. Stearns).

PANDALUS STENOLEPIS Rathbun.

Plate II, fig. 4.

Pandalus stenolepis RATHBUN, Proc. U. S. Nat. Mus., XXIV, 901, 1902.

Differs from *P. danae*:

(1) In the stouter eyes, the transverse diameter being as great as the axial diameter.

(2) In the more slender antennal scale. This scale has a concave outer margin, and the distal half of the blade is very narrow and filiform, narrower than the adjacent thickened portion.

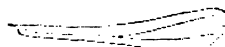


FIG. 14. *Pandalus stenolepis*.
 Acicle (X 2). Station 3464.

(3) The first pair of feet is longer, reaching almost to the extremity of the maxillipeds.

(4) The third, fourth, and fifth pairs of feet in the male, while shorter than in the female, as in *P. danae*, do not differ in shape from those of the female, as in the older species.

(5) In the tip of the rostrum, usually 2-spined, though occasional specimens have 3 spines.

Dimensions.—Adult female (station 3464), length 80 mm., length of carapace and rostrum 37.2 mm., of rostrum 21 mm.

Distribution.—From the Aleutian Islands to Oregon, 27 to 125 fathoms. Taken at the following stations:

Pumicestone Bay, Unalaska, 59 fathoms, station 3319.
 Iliuliuk Harbor, Unalaska, 85 fathoms, station 3311.
 Off Akutan Island, Alaska, 36 fathoms, station 3546.
 Unimak Pass, Alaska, 34 fathoms, station 3220.
 Northwest of Unimak Island, Alaska, 43 fathoms, station 3262.
 Southwest of Sannak Islands, Alaska, 41 fathoms, station 3213.
 Off Cape Beale, Vancouver Island, 34 fathoms, station 2879.
 Off Cape Flattery, Washington, 27-40 fathoms, stations 2873, 2874.

Strait of Fuca, 37-125 fathoms, stations 3443, 3445, 3451, 3452, 3458, 3459, 3461, 3462, 3464 (type locality), 3593.
 Off Alsea River, Oregon, 42 fathoms, station 3085.
 Off Heceta Bank, Oregon, 68 fathoms, station 3078.
 Heceta Bank, Oregon, 42-50 fathoms, stations 2886, 2887, 2889.
 Granite Cove, Port Althorp, Alaska (W. H. Dall).

PANDALUS GURNEYI Stimpson.

Plate 11, fig. 6.

Pandalus gurneyi STIMPSON, Ann. Lyc. Nat. Hist. N. Y., x, 128, 1871. Monterey, Calif.

The species which I take to be *P. gurneyi* is very near *P. danae*. Our adult specimens are smaller than *P. danae*; rostrum longer, being from one and a half to one and two thirds longer than the carapace. Median dorsal spines 8 or 9, rather distant, ventral spines 9 or 10. Antennular peduncle only two fifths as long as acicle; the flagella are subequal and one and a half times as long as carapace, the thickened portion of the outer one being a little over half the entire length; the basal scale is rounded, not angled.

Antennal scale as long as carapace, flagellum exceeding length of body.

Maxillipeds reaching three fourths the length of antennal scale, first pair of feet reaching nearly as far. Right leg of second pair extends to tip of acicle, carpal segments 17; left leg one third longer than right, carpal segments about 45.

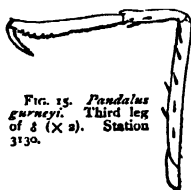
As the last three pairs of feet are about the same length as in *P. danae*, it follows that in the female the third pair does not reach as far beyond the rostrum as in that species, or fails to reach the end of the rostrum.

In the male the last three pairs of legs are shorter than in the female, and the propodus of the third pair is slightly re-curved and narrowed at the extremity, forming a margin against which the dactylus closes; this is, if I mistake not, the condition which Stimpson describes as 'subcheliform.'

Sixth segment of abdomen one and a half times as long as wide; seventh less than one and a half times as long as sixth, 5 spinules on each side.

Otherwise as in *P. danae*.

Dimensions.—Ovigerous female (station 2961), length 77.5 mm., length of carapace and rostrum 38.5 mm., of rostrum 25 mm.



Distribution.—Southern California, 9 to 55 fathoms (rare). Taken at the following stations by the *Albatross*:

Monterey Bay, 9 fathoms, station 3130.

Off Santa Barbara, 21 fathoms, station 2961.

Off San Miguel Island, 55 fathoms, station 2959.

Off Santa Cruz Island, 30 fathoms, stations 2944, 2945.

Off Santa Rosa Island, 52 fathoms, station 2956.

Genus *Pandalopsis* Bate.

KEY TO THE SPECIES OF PANDALOPSIS.

- A. Rostrum with spines on distal half of upper margin . . . *dispar*.
- A'. Rostrum without spines on distal half of upper margin.
- B. Dorsal spines not continued to middle of carapace . . . *ampla*.
- B'. Dorsal spines continued to middle of carapace.
- C. Palm of chela more than one and a half times as long as fingers.
Rostrum less than twice as long as carapace proper . . . *aleutica*.
- C'. Palm of chela less than one and a half times as long as fingers. Rostrum more than twice as long as carapace proper . . . *longirostris*.

PANDALOPSIS AMPLA Bate.

Pandalopsis amplus BATE, Challenger Rept., XXIV, 671, pl. CXV, fig. 3, 1888.
Pandalopsis ampla FAXON, Mem. Mus. Comp. Zool., XVIII, 155, 1895.

Surface remotely punctate. Rostrum one and a third to one and nine tenths times as long as the rest of the carapace (in small specimens it may be two and a half times the carapace), slightly ascending, slightly arched above the eyes. Median crest occupying the anterior two thirds of the carapace, armed with 7 to 13 movable spines, of which 3 to 5 are on the carapace and in front of the middle, the anterior spine considerably behind the middle of the rostrum. There is also a subterminal fixed spine; and occasionally two subterminal spines—both above, or one above and one below. Greater part of the rostrum unarmed above. Lower margin armed with 13 to 16 slender spines, larger toward the base of the rostrum. Suborbital spine slender, prominent. Pterygos-tomian spine short and slender.

Eyes very stout, ocellus rudimentary. The peduncle of the antenna extends to the middle or nearly to the middle of the antennal scale; the second segment is twice as long as the third; inner flagellum at least half as long as the body; outer flagellum one fourth longer than inner, thicker at the base, but gradually tapering. The peduncle of the antenna does not reach quite to the end of the second segment of the antennular peduncle; flagellum one and a third times the length of the

body. Scale four fifths to eight ninths as long as carapace; blade broadly rounded at the tip and exceeded by the spine.

The maxilliped falls considerably short of the tip of antennal scale, but its penultimate segment reaches to or beyond the end of the antennular peduncle.

The ischium of the first pair of feet is dilated in a thin, broad laminar inferior projection, which is anteriorly lobiform; the terminal segment overlaps a little that of the maxilliped. The feet of the second pair are equal; the carpus has 20 to 24 segments; the right and left carpi may or may not have an equal number of segments; the chela is as long as the five adjacent segments of the carpus. The third, fourth, and fifth pairs of feet are slender and similar, and armed with slender spines; while they diminish regularly in length from the third to the fifth, their propodi increase in length proportionally; the dactyli are short and contained from five to six times in their respective propodi. The third pair overreaches the acicle by the length of the dactylus and at least half the propodus.

The third segment of the abdomen is moderately produced backward in the middle, forming a lobe in the posterior margin; the sixth segment is nearly two and a half times as long as wide, and about two thirds as long as the seventh; this has 5 to 8 spinules on each side, of which the anterior is just in front of the middle.

Dimensions.—Length 164 mm., length of carapace and rostrum 85.7 mm., of rostrum 57.5 mm.

Distribution.—From Washington to Mexico; off Monte Video; 309–984 fathoms:

Off Monte Video, 600 fathoms (*Challenger*, type locality).

Off Acapulco, 660 fathoms, station 3418, and near Tres Marias Islands, Mexico, 676 fathoms, station 3424 (*Albatross*, Faxon).

Off Cortez Bank, California, 984 and 776 fathoms, stations 2919 (one young) and 3627.

Off San Diego, 822 and 623 fathoms, stations 2983 (abundant) and 2929.

Off Sea Lion Rock, Washington, 877 and 859 fathoms, stations 3074 and 3075 (abundant).

PANDALOPSIS ALEUTICA Rathbun.

Plate 1, fig. 1.

Pandalopsis aleutica RATHBUN, Proc. U. S. Nat. Mus., XXIV, 901, 1902.

Surface of carapace covered with a short and soft pubescence. Branchial region traversed by a curved longitudinal ridge. Rostrum one and

one seventh to one and a half times the length of the rest of the carapace, ascending. Anterior two thirds of carapace furnished with a median crest. Median spines 8 to 13, four to six of which are behind the orbits, the insertion of the posterior spine being at the middle of the carapace; the anterior spine is behind the middle of the rostrum; this is exclusive of a subterminal spine. Inferior spines 8 to 12.

The peduncle of the antennula extends a little past the middle of the antennal scale; the second segment one and a half times as long as third; outer flagellum two thirds as long as body, inner flagellum shorter.

Peduncle of antenna reaching to end of second antennular segment; scale three fourths to four fifths as long as carapace, broader behind than in *P. ampla*; flagellum one and a half times the length of the body.

The outer maxillipeds extend either to the tip or nearly to the tip of antennal scale; the first pair of pereopods overreach the penultimate segment of the maxilliped; second pair subequal, extending beyond acicle, carpal segments 18 to 21, chela equal in length to five and a half or six of the adjoining segments of the carpus; palm more than one and a half times as long as fingers. There is very little difference in the length of the third, fourth, and fifth pairs of feet; the third pair reaches beyond the acicle by the length of the dactylus and half the propodus; the dactyli are contained about five and a half times in their propodi.



FIG. 16. *Pandalopsis alcutica*. Chela of ♀ (X 2½). Station 3480.

The pleon is much like that of *P. ampla*; the pleura of the second segment are narrower than in *P. ampla*; the sixth segment is shorter, only twice as long as wide.

For the rest, as in *P. ampla*.

Dimensions.—Adult female, length 132 mm., length of carapace and rostrum 61.5 mm., of rostrum 33 mm.

Distribution.—Over one hundred specimens were taken by the *Albatross* at station 3480, off Seguam, Aleutian Islands, 283 fathoms (type locality). North of Rat Islands, Aleutians, 270 fathoms, station 3785.

Affinities.—Besides its resemblance to *P. ampla*, this species is also similar to *P. lamelligera* (Brandt), from Kamchatka, but differs in the fewer dorsal spines, in the longer feet of the first pair, and in the narrower pleura of the second segment of the pleon.

PANDALOPSIS LONGIROSTRIS Rathbun.

Pandalopsis longirostris RATHBUN, Proc. U. S. Nat. Mus., XXIV, 902, 1902.

Male.—Surface smooth. Rostrum a little more than twice as long as the carapace proper, strongly ascending, and continued backward in a

carina behind the middle of the carapace, armed with 9 movable spines, four of which are on the carapace (the hinder one inserted very slightly behind the middle) and five on the base of the rostrum; 1 subterminal immovable spine; lower margin armed with 11 immovable spines.

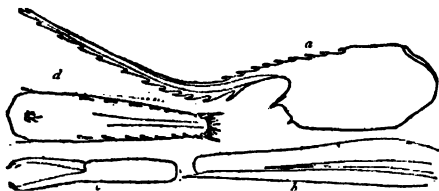


FIG. 17. *Pandalopsis longirostris*. Station 3316. a. Side of carapace (natural size). b. Acicle (X 2). c. Chela (X 31). d. Telson (X 2).

Antennular peduncle extending to middle of scale. Scale as long as carapace. Antennal pe-

duncle reaching to middle of second antennular segment. Maxillipeds reaching almost to end of scale, very stout and hairy. The first pair of pereopods overlaps the basal fourth of the last joint of the maxillipeds; second pair extending beyond acicle by length of chela, carpus of 21 joints, chela equal to the seven adjoining segments, fingers almost as long as palm; third pereopods extending beyond the acicle by the length of the dactylus and two thirds of the propodus.

Sixth segment of abdomen two and a half times as long as wide; telson broader than in *P. aleutica*.

Dimensions.—Male, length 112 mm., carapace and rostrum 59 mm., rostrum 41 mm.

Distribution.—Off Iliuliuk Harbor, Unalaska, 309 fathoms, station 3316, *Albatross*, 2 males (one without rostrum).

PANDALOPSIS DISPAR Rathbun.

Plate 1, fig. 2.

Pandalopsis dispar RATHBUN, Proc. U. S. Nat. Mus., XXIV, 902, 1902.

Surface very finely and closely punctate. Rostrum two to two and a half times the length of the rest of the carapace, arched over the eyes, the remainder slightly ascending. Median crest occupying two thirds the length of the carapace, posterior spine at the anterior third, spines 16 to 21, three or four of which are on the carapace, spines closely placed on the arch, distant on the remainder of the rostrum. Inferior spines 9 to 15, extremity bifid or sometimes trifid. Antennal spine long and slender; pterygostomial spine minute.

Eyes very large, with a very small but distinct ocellus outside the corneal area.

Antennal peduncle reaching two fifths the length of antennal scale;

third segment but little shorter than second; outer basal scale a narrow lobe; outer flagellum one third longer than the body; inner flagellum one half as long as the outer. Antennal scale a little shorter than the carapace, tapering distally; extremity of blade obliquely rounded and exceeding the spine; peduncle reaching end of second segment of antennular peduncle; flagellum one and a half times length of body.

The outer maxillipeds reach to the distal fifth or sixth of the antennal scale. The first pair of feet overlap the proximal third of the terminal joint of the maxilliped. Second pair subequal, overreaching the acicle a little; carpus composed of from 26 to 33 segments. Third to fifth pairs of feet nearly equal, the third reaching beyond the acicle by length of dactylus and one half or more of propodus, their propodi increasing in length from the third to the fifth pair, while the dactyli increase in reverse order; so that while the dactylus of the third pair may be contained three and a half or four times in the corresponding propodus, the dactylus of the fifth pair is contained seven or eight times in its propodus; the spines of the meral and carpal segments are replaced by bristles on the propodi; dactyli subentire, although there may be a few small very appressed spinules at the base of the concave surface.

Abdomen two and four fifths to three times as long as the carapace (exclusive of rostrum); third segment slightly compressed, its posterior margin produced in a short subacute lobe. Sixth segment nearly three times as long as wide and three fourths as long as seventh; seventh with five to seven spinules on each side.

Outer branch of tail-fan about as long as the telson; inner branch much shorter.

Dimensions.—Length of female 181 mm., length of carapace and rostrum 100.5 mm., length of rostrum 73.5 mm. Length of female (station 3675) 211.5 mm.

Distinctive characters.—The spines distributed along the whole upper margin of the rostrum, the unequal dactyli of the third to fifth pairs of feet, and the inequality of the branches of the swimming-fan easily distinguish this species from the preceding.

Distribution.—From Bering Sea to Washington, 53 to 351 fathoms, at the following stations of the *Albatross*:

Bering Sea, west of Pribilof Islands, 184 fathoms, station 3489.
Chernofski Harbor, Unalaska, 109 fathoms, station 3324 (type locality).
North of Unalaska, 351, 350 fathoms, stations 3330, 3331.
Between Unga and Nagai Islands, Shumagins, 110 fathoms, station 2848.
Off the Trinity Islands, 159 fathoms, station 2853.
Clarence Strait, Alaska, 322 fathoms, station 3077.
Queen Charlotte Sound, British Columbia, 238 fathoms, station 2862.

Off Strait of Fuca, 142 fathoms, station 3457.

Strait of Fuca, 53-136 fathoms, stations 3446-3449, 3451, 3452, 3456, 3458-3460, 3596, 3597.

Puget Sound, 82-135 fathoms, stations 3067, 3068.

Off Tahwhit Head, Washington, 178 fathoms, station 3076.

Stations 3675, 3676 (locality not given), 110 and 122 fathoms.

Family *HIPPOLYTIDÆ*.

Genus *Hippolyte* Leach.

HIPPOLYTE CALIFORNIENSIS Holmes.

Distribution.—From Sitka, Alaska, to San Diego, California. Specimens are in the National Museum from Sitka, 10 fathoms (Harriman Expedition, one specimen); Barclay Sound, British Columbia (*Albatross*, one specimen); Puget Sound (T. Kincaid, several specimens); Bodega Bay, California (determined by S. J. Holmes); San Diego, California (*Albatross*).

The Sitka specimen, about 24 mm. long, has on the rostrum 3 teeth above on basal half, below 3 near the middle and 1 near the tip. The example from Barclay Sound has 2 teeth above on basal half, and 1 near the tip, below 2 near the middle and 1 near the tip. In a lot of eleven specimens from Puget Sound, the dorsal teeth are usually 2 (in one case 3) on basal half of rostrum, and 1 or none near tip. In the few individuals from San Diego the rostral teeth are typical.

Genus *Hippolysmata* Stimpson.

HIPPOLYSMATA CALIFORNICA Stimpson.

Distribution.—From Santa Barbara to San Diego, California.

Genus *Spirontocaris* Bate.

(Includes *Heptacarpus* Holmes.)

KEY TO THE SPECIES OF SPIRONTOCARIS.

- A. One or more supraorbital spines present.
 - B. Rostrum subcircular. Median spines of carapace compound or formed by short transverse rows of small spines. 3 or 4 supraorbital spines *prionota*.
 - B'. Rostrum not subcircular, usually elongate. Median spines of carapace simple, or not formed by transverse rows of small spines. Not more than 2 supraorbital spines.
 - C. First to third abdominal segments laterally acute or spinous.
 - D. First and second abdominal segments armed with slender spines. Rostrum narrow *grænlandica*.

- D'. First and second abdominal segments laterally acute. Rostrum deep *lamellicornis*.
- C'. First to third abdominal segments laterally rounded, not acute.
- D. Two supraorbital spines.
 - E. Rostrum longer than the remainder of the carapace and with a long slender tip *bispinosa*.
 - E'. Rostrum shorter than the remainder of the carapace.
 - F. Rostrum not reaching end of antennular peduncle *truncata*.
 - F'. Rostrum reaching beyond end of antennular peduncle.
 - G. Antennular scale not reaching middle of second segment of peduncle.
 - H. Dorsal spines all in front of middle of carapace *sica*.
 - H'. Dorsal spines continued posterior to middle of carapace *snyderi*.
 - G'. Antennular scale reaching beyond middle of second segment of peduncle.
 - H. Dorsal spines not reaching to posterior third of carapace.
 - J. Upper limb of rostrum gradually diminishing in width from the orbit to the tip . . . *phippisii*.
 - J'. Upper limb of rostrum arcuate, widest in the middle.
 - K. Rostrum extending only to end of antennular peduncle, deep, usually bifid at tip *ochotensis*.
 - K'. Rostrum extending nearly to end of antennal scale, less deep, tip acute *dalli*.
 - H'. Dorsal spines continued to posterior third of carapace.
 - J. Midrib of rostrum terminating in a spine which projects well beyond lower limb of rostrum.
 - K. Eyes large, pyriform. Spine of antennal scale extending beyond lamellar portion *liljeborgii*.
 - K'. Eyes of moderate size, subcylindrical. Spine of antennal scale not reaching beyond lamellar portion *murdochi*.
 - J'. Midrib of rostrum terminating in a spine which does not project beyond lower limb of rostrum.
 - K. Upper margin of carapace and rostrum in ♀ convex. Third abdominal segment in ♂ in profile not projecting behind fourth segment *arcuata*.
 - K'. Upper margin of carapace and of rostrum in ♀ separated by a depression. Third abdominal segment in ♂ in profile projecting in a horn-like process behind fourth segment . *spina*.
- D'. One supraorbital spine.

E. Rostrum less than twice as long as the eye *washingtoniana*.

E'. Rostrum twice or more than twice as long as the eye.

F. Antennular scale shorter than first segment of peduncle
vicina.

F'. Antennular scale longer than first segment of peduncle.

G. Fifth segment of abdomen not armed with a spine on either side *affinis*.

G'. Fifth segment of abdomen armed with a spine on either side.

H. Rostrum longer than the rest of the carapace
unalaskensis.

H'. Rostrum no longer than the rest of the carapace
polaris.

A'. No supraorbital spine or spines.

B. Rostrum about as long as or longer than the rest of the carapace.

C. Third, fourth, and fifth segments of abdomen carinated, the carina on each segment terminating in a sharp spine . . . *barbata*.

C'. Third, fourth, and fifth segments not all carinated nor ending in a sharp spine.

D. Terminal half (at least) of rostrum devoid of spines above.

E. Third abdominal segment with an angle or hump, in profile, toward the posterior end.

F. More than 3 dorsal teeth, one or more in front of eyes.

G. Sixth abdominal segment less than twice as long as wide. Rostrum deep, one fourth as deep as long
carinata.

G'. Sixth abdominal segment more than twice as long as wide. Rostrum more slender.

H. Maxilliped with epipod. Scale at base of antennula extending beyond first segment *flexa*.

H'. Maxilliped without epipod. Scale at base of antennula not reaching beyond, or only slightly beyond, first segment *gracilis*.

F'. Three dorsal teeth, none in front of eyes . . . *tridens*.

E'. Third abdominal segment smoothly rounded, without angle or hump.

F. One or more superior rostral spines in front of eyes.

G. No pterygostomian spine *stylus*.

G'. A pterygostomian spine *amabilis*.

F'. No superior rostral spine in front of eye . . . *fabricii*.

D'. Terminal half of rostrum with spines (in part at least).

E. Terminal third of rostrum unarmed above and below
biunguis.

E'. Terminal third of rostrum not entirely unarmed.

F. Sixth abdominal segment longer than seventh . . . *decora*.

F'. Sixth abdominal segment shorter than seventh.

G. Maxilliped exceeding acicle.

H. Rostrum straight above. Epipods on maxillipeds and first two thoracic feet *paludicola*.

- H'. Rostrum concave above. Epipods on maxillipeds and first foot only. *meseri*.
- G'. Maxilliped not exceeding acicle.
- H. Third abdominal segment with a lobe (in profile), which is in the form of a hook in the ♂, of a hump in the ♀. 8 to 12 dorsal spines
gaimardii belcheri.
- H'. Third segment without a lobe (in profile) in the ♀.
- J. Rostrum with more than 8 spines above . . . *layi*.
- J'. Rostrum with 8 or fewer than 8 spines above.
- K. Fourth abdominal segment with a spine on either side *suckleyi*.
- K'. Fourth abdominal segment without spine.
- L. Sixth segment barely twice as long as high.
- M. Maxillipeds reaching just beyond middle of acicle *camtschatica*.
- M'. Maxillipeds reaching nearly to end of acicle *kincaidi*.
- L'. Sixth segment more than twice as long as high *townsendi*.
- B'. Rostrum shorter than the rest of the carapace.
- C. Upper and lower limbs of rostrum deep and with convex margins.
- D. Upper limb of rostrum deepest above the eye . . . *macilentia*.
- D'. Upper limb narrow above the eye . . . *macrophthalma*.
- C'. Upper and lower limbs of rostrum not both convex.
- D. Rostrum elongate, reaching beyond the middle of the antennal scale.
- E. Upper margin of rostrum concave.
- F. Fingers of first pair of chelipeds less than one third as long as palm. No pterygostomial spine. No spine on fourth segment of abdomen . . . *brachydactyla*.
- F'. Fingers of first pair of chelipeds about half as long as palm. A pterygostomial spine or spinule. A spine or spinule on fourth segment of abdomen *maxillipes*.
- E'. Upper margin of rostrum straight.
- F. Antennal peduncle reaching end of antennular peduncle
picta.
- F'. Antennal peduncle reaching end of second segment of antennular peduncle *sitchensis*.
- D'. Rostrum short, not reaching beyond the middle of the antennal scale.
- E. Rostrum not reaching as far as the cornea . . . *taylori*.
- E'. Rostrum reaching as far as or beyond the cornea.
- F. Rostrum not reaching the second segment of antennular peduncle.
- G. Rostrum with superior margin strongly convex over the eyes, extremity straight *avina*.
- G'. Rostrum with superior margin not strongly convex over the eyes, but nearly straight.

- H. Maxilliped with exopod *pusiola*.
- H'. Maxilliped without exopod.
- J. Antennal scale about same length as, or shorter than, telson *brevirostris*.
- J'. Antennal scale longer than telson . . . *palpator*.
- F'. Rostrum reaching second segment of antennular peduncle.
- G. Rostrum straight *herdmani*.
- G'. Rostrum arched over the eye.
- H. Fourth segment of abdomen with lateral spinule. Maxillipeds reaching, or nearly reaching, end of acicle *cristata*.
- H'. Fourth segment of abdomen unarmed. Maxillipeds reaching only to distal third of acicle . . *stoncyi*.

SPECIES OF SPIRONTOCARIS, ARRANGED ACCORDING TO THEIR
EXOPODS AND EPIPODS.

- A. One or more supraorbital spines present.
 - B. Third maxilliped with exopod and epipod.
 - C. First thoracic foot with epipod *sica*.
 - C'. First and second thoracic feet with epipods . *bispinosa*, *snyderi*.
 - C''. First, second, and third thoracic feet with epipods
prionota, *lamellicornis*, *spina*, *arcuata*, *murdochi*,
truncata?, *liljeborgii*, *phippisii*, *ochotensis*, *dalli*.
 - B'. Third maxilliped without exopod but with epipod.
 - C. First thoracic foot with epipod *vicina*.
 - C'. First and second thoracic feet with epipods *polaris*, *unalaskensis*.
 - C''. First, second, and third thoracic feet with epipods
grænlandica, *washingtoniana*.
 - B''. Exopods and epipods unknown *affinis*.
- A'. No supraorbital spine or spines.
 - B. Third maxilliped with exopod and epipod.
 - C. Thoracic feet without epipods *barbata*, *biunguis*, *macrophthalmia*.
 - C'. First thoracic foot with epipod
fabricii (usually), *suckleyi* (usually).
 - C''. First and second thoracic feet with epipods
fabricii (sometimes), *gaimardii* *belcheri*, *townsendi*, *suckleyi* (sometimes).
 - C'''. First, second, and third thoracic feet with epipods
pusiola, *herdmani*, *stoncyi*, *avina*, *macilentia*.
 - B'. Third maxilliped without exopod but with epipod.
 - C. Thoracic feet without epipods
decora, *tridens*, *stylus*, *maxillipes*,
brachydactyla, *camtschatica*, *kincaidi*.
 - C'. First thoracic foot with epipod *moseri*, *sitchensis*.
 - C''. First and second thoracic feet with epipods
flexa, *picta*, *paludicola*.
 - C'''. First, second, and third thoracic feet with epipods
carinata, *palpator*, *brevirostris*, *taylori*, *cristata*.

- B". Third maxilliped without exopod or epipod. Thoracic feet without epipods *gracilis*.
 B". Exopods and epipods unknown *amabilis, layi*.

SPIRONTOCARIS PRIONOTA (Stimpson).

- Hippolyte prionota* STIMPSON, Proc. Acad. Nat. Sci. Phila., 153, 1864.—KINGSLEY, Bull. Essex Inst., XIV, 127, pl. II, fig. 9, 1883.—SHARP, Proc. Acad. Nat. Sci. Phila., 117, 1893.
Spirontocaris prionota WALKER, Trans. Liverpool Biol. Soc., XII, 277, 1898.
Spirontocaris prionota HOLMES, Occas. Papers Calif. Acad. Sci., VII, 206, 1900.

To Kingsley's figure one must add 2 or 3 supraorbital spines arranged in a longitudinal series. While 3 seems to be the normal number, the anterior one is often reduced and sometimes wanting.

Distribution.—From Bering Sea to Monterey, California:

- Dutch Harbor, Unalaska, and Kadiak (Harriman Expedition, W. R. Coe).
 Collected by W. H. Dall at Cape Etolin, Nunivak Island, 8 fathoms; Captains Harbor, Unalaska, 9 and 80 fathoms; Coal Harbor, Unga, 8-9 fathoms; Belkofski Bay, 15-25 fathoms; Chiniak Bay, Kadiak; Chugachik Bay, Cook Inlet, 20-60 fathoms.
 Dredged by the *Albatross* in Bristol Bay, Alaska, $7\frac{1}{4}$ and $10\frac{1}{2}$ fathoms, stations 3232 and 3233; off North Head, Akutan Island, 72 fathoms, station 2842; Unimak Pass, 34 fathoms, station 3220; North of Bird Island, Shumagins, 21 fathoms, station 2850; Admiralty Inlet, Puget Sound, 40 fathoms, station 2865.
 Puget Sound (T. Kincaid).
 Pacific Grove, California (J. O. Snyder).
 Bering Island, 2-12 fathoms, some in stomach of *Gadus macrocephalus* (N. Grebnitzky).
 Puget Sound (Stimpson); Marmot Isles, Alaska, 45 fathoms (Sharp); Monterey, California (Holmes).

SPIRONTOCARIS GRÆNLANDICA (J. C. Fabricius).

- Astacus Grænländicus* J. C. FABRICIUS, Syst. Entom., 416, 1775; Entom. syst. auct. et emend., II, 484, 1793 (*grænlandicus*).
Cancer aculeatus O. FABRICIUS, Fauna Grænlandica, 239, 1780.
Alpheus Aculeatus SABINE, in Supplement to Appendix of Parry's [First] Voyage, p. CCXXXVII, pl. II, figs. 9 and 10, 1824.
Hippolyte aculeata J. C. ROSS, in John Ross, Appendix to Narrative of a Second Voyage in Search of a North-West Passage, II, p. lxxxiii, 1835.
Hippolyte armata OWEN, in Zoology of Capt. Beechey's Voyage [of the Blossom], Crustacea, p. 88, pl. XXVII, fig. 2, 1839 (♀).
Hippolyte cornuta OWEN, *op. cit.*, p. 89, pl. XXVIII, fig. 2, 1839 (♂).
Hippolyte grænlandica MIERS, Ann. Mag. Nat. Hist. (4), XX, 62 (12), 1877.—SMITH, Trans. Conn. Acad. Arts Sci., v, 85, pl. x, fig. 2, 1879.
Spirontocaris grænlandica WALKER, Trans. Liverpool Biol. Soc., XII, 276, 1898.—HOLMES, Occas. Papers Calif. Acad. Sci., VII, 236, 1900.

The number of spines on the abdomen is the same in the two sexes,

but there is some individual variation. The usual number of spines is one on the second and sixth segments and two on each of the other segments.

Distribution.—Arctic coast of America; Bering Sea to Puget Sound; Kamchatka; Okhotsk Sea; Atlantic coast of America from Greenland to Narragansett Bay, Rhode Island, 1–72 fathoms:

Berg Bay, Glacier Bay, Alaska (Harriman Expedition).

Dredged by the *Albatross* from off Cape Menshikof, Bering Sea, to the Aleutian Islands and Portlock Bank, Alaska, in 16 to 72 fathoms; at the unusual depth of 283 fathoms, off Seguam, Aleutians, a lot of large specimens, the largest ♀ measuring 77 mm., the largest ♂ 67 mm.; Strait of Fuca and Puget Sound, 40–48 fathoms; off Kamchatka, 12 and 42 fathoms, stations 3780 and 3781; Avacha Bay, Kamchatka, 16 fathoms, station 3642; Rakovaya Bay, Avacha Bay; off Robben Island, Okhotsk Sea, 10 fathoms, station 3645.

Various localities from Kadiak westward along the Aleutian Islands, in 3–25 fathoms (W. H. Dall).

Puget Sound (T. Kincaid).

Avacha Bay and Petropavlovsk, Kamchatka (L. Stejneger).

Bering Island, among Laminaria, and Solovarennaja Bay, Petropavlovsk, Kamchatka, 10–12 fathoms (N. Grebnitzky).

Arctic Ocean (Stimpson).

SPIRONTOCARIS LAMELLICORNIS (Dana).

Hippolyte lamellicornis DANA, Proc. Acad. Nat. Sci. Phila., 1852, 24; Crust. U. S. Expl. Exped., 1, 567, 1852, pl. xxxvi, fig. 6, 1855.—STIMPSON, Jour. Boston Soc. Nat. Hist., VI, 498, 1857.—KINGSLEY, Bull. Essex Inst., x, 62, 1878.

Spirontocaris lamellicornis WALKER, Trans. Liverpool Biol. Soc., XII, 277, 1898.—HOLMES, Occas. Papers Calif. Acad. Sci., VII, 208, 1900.

This species, though resembling strongly *S. spina*, is at once separated by the acuteness of the lateral margins of the first to third abdominal segments, which in *S. spina* are broadly rounded. The rostrum is about three fourths as long as the rest of the carapace, and does not exceed the antennal scale, although it may exceed the blade of the scale. The spine of the scale extends beyond the blade to a distance



FIG. 18. *Spirontocaris lamellicornis*. Side of carapace of ♀ (X 11). Station 3046.

equaling or exceeding the distal width of the blade. The dactyli of the last three pairs of feet are longer than in *S. spina*, those of the last pair being half the length of their propodi; they are armed with spinules so minute that the segment appears entire in comparison with *S. spina*.

Dimensions.—♀, length 63 mm., carapace 23 mm.

Distribution.—This species occurs sparingly from Unalaska to Point Arena, California; 9–77 fathoms.

It has been taken by W. H. Dall at Captains Harbor, Unalaska, 9 fathoms; Port Etches, 12–18 fathoms; Sitka Harbor, 15 fathoms. By the *Albatross* at Gulf of Georgia, British Columbia, 67 fathoms, station 2863; Strait of Fuca, 53 fathoms, station 3460; Bellingham Bay, Washington, 11 fathoms, station 3612; off Destruction Island, Washington, 32 fathoms, station 2869; off Grays Harbor, 48–58 fathoms, stations 2870, 3046–3048; off Columbia River, 68 fathoms, station 2882; off Oregon, 38–77 fathoms, stations 3057–3059; off Point Arena, California, 51 fathoms, station 3351.

SPIRONTOCARIS SPINA¹ (Sowerby).

Plate III, fig. 5.

Cancer spinus SOWERBY, British Miscellany, 47, pl. XXIII, 1805 (*teste* Stebbing).

Alpheus spinus LEACH, Edinb. Encyc., VII, 431, 1814; Philadelphia reprint, VII, 271.

Alpheus Spinus LEACH, Trans. Linn. Soc. London, XI, 347, 1815.

Hippolyte Sowerbæi LEACH, Malac. Pod. Brit., pl. XXXIX, 1817.

Hippolyte sowerbei J. C. ROSS, in John Ross, Appendix to Narrative of a Second Voyage in Search of a North-West Passage, II, p. lxxxiii, pl. B, fig. 2, 1835.

Hippolyte spinus WHITE, List Crust. Brit. Mus., 76, 1847.—BELL, Hist. Brit. Crust., 284, 1853.—SMITH, Trans. Conn. Acad. Arts Sci., v, 68, 1879.

Hippolyte spina STIMPSON, Proc. Acad. Nat. Sci. Phila., XII, 34 (103), 1860; Ann. Lyc. Nat. Hist. N. Y., x, 126, 1871.

Spirontocaris spinus BATE, Challenger Report, XXIV, 596, pls. CVI and CVII, 1888 (part).—RATHBUN, The Fur Seals and Fur-Seal Islands of the North Pacific Ocean, Pl. III, 556, 1899 (part).

There is considerable variation, in this species, in the height of the carapace in proportion to its length; in the eyes, which may be widely pyriform or smaller and subcylindrical; in the length of the outer maxillipeds (in none of the Pacific specimens do the maxillipeds reach the end of the acicle, while in many Atlantic ones they do); in the carination and the length of the spine of the third abdominal segment.



FIG. 19. *Spirontocaris spina*. Side of carapace of ♀ (X 12). Station 2842.

¹In regard to *spina* vs. *spinus*, Stimpson says (Ann. Lyc. Nat. Hist. N. Y., x, 126, 1871): "Sowerby, by the name he gave to this species, doubtless had reference to a spine, or the backbone: in Latin *spina*, not *spinus*. *Spinus* is not an adjective, and means only the sloe-tree, which could scarcely have been intended." While *spinus* has another signification, from *σπινος*, the name of a small bird, yet it was without doubt used by Sowerby to call attention to the spine or spines of the animal.

Ross (*loc. cit.*) probably represents the ♂ of *S. spina*, but the shape of the rostrum is inaccurate; both upper and lower laminæ should have more convex margins.

Distribution.—Circumpolar. Arctic Alaska, Bering Strait, Bering Sea, Aleutian Islands, and Alaska Peninsula to Lituya Bay, 5-91 fathoms; Atlantic Ocean southward to Massachusetts Bay, 5-90 fathoms; northern Europe:

Taken by the *Albatross* at the following stations:

Off the Pribilof Islands, 41-62 fathoms, stations 3439, 3442, 3482, 3483, 3485, 3505, 3540, 3544, 3554, 3560, 3561.
Off Bristol Bay, 30 fathoms, station 3302.
Off Cape Stroganof, 30 fathoms, station 3293.
Off Kudobin Islands, 36 fathoms, station 3280.
Off Akutan Island, 56-91 fathoms, stations 2841, 2842, 3548.
Pumicestone Bay, Unalaska, 35 fathoms, station 3322.
Northwest of Unimak Island, 81 fathoms, station 3257.
South of Unimak Island, 42 fathoms, station 3217.
Between Bird and Nagai Islands, Shumagins, 35 fathoms, station 2851.

Collected by Dr. Dall at:

Bering Strait, 12 fathoms.
Bay of Islands, Adak, 9-16 fathoms.
Nazan Bay, Atka, 10-16 fathoms.
Captains Harbor, Unalaska, 9-80 fathoms.
Port Levashef, Unalaska.
Lituya Bay, 6-9 fathoms.
Off Point Hope, Arctic Alaska, 25 fathoms (U. S. R. S. *Corwin*).
Lorenz Bay and Plover Bay (Richters).

SPIRONTOCARIS ARCUATA Rathbun.

Plate III, fig. 4.

Spirontocaris spinus RATHBUN, The Fur Seals and Fur-Seal Islands of the North Pacific Ocean, Pt. III, 556, 1899 (part).

Spirontocaris arcuata RATHBUN, Proc. U. S. Nat. Mus., XXIV, 893, 1902.

On the Pacific coast, associated in part with *S. spina*, is a very closely allied species, easily mistaken for *S. spina*, but apparently distinct. In the adult ♀, the upper line of carapace and rostrum in profile forms a single curve, without the sinus shown in *S. spina*; the rostrum is on a higher level than in that species, the rostral spines larger and more distinctly marked; the posterior lobe of the third abdominal segment shorter and broader; the sixth segment considerably shorter, being less than one and a half times as long as wide,



FIG. 20. *Spirontocaris arcuata*. Side of carapace of ♀ (X 18). Station 2864.

while in *S. spina* it is more than one and a half times as long as wide; the maxillipeds reach to the tip of the antennal scale; the dactyli of the third to fifth pairs of feet are shorter than in *S. spina*, that of the last pair being contained at least three times in the propodus, while in *S. spina* the dactylus of the last pair is contained only two and a half times in its propodus.

The males of this species and of *S. spina* are more difficult of determination. The rostrum has the midrib more strongly curved upward, the upper limb deeper and with more convex superior outline than in *S. spina*. The same differences in the abdomen exist as in the females of the two species, but in a lesser degree.

Dimensions.—♀, length 53.8 mm., length of carapace and rostrum 20 mm., of rostrum 8 mm.

Distribution.—From Pribilof Islands to Strait of Fuca; 3–350 fathoms. A more southerly range than that of *S. spina*.

Harriman Expedition.—Kadiak, 5 fathoms (W. R. Coc); Berg Bay, Glacier Bay; Juneau, 20 fathoms.

Collected by the *Albatross*:

Off Pribilof Islands, 48–150 fathoms, stations 3484, 3486, 3500, 3561, 3602.

Off Cape Menshikof, 24 fathoms, station 3296.

Off Cape Strogonof, 26 fathoms, station 3291.

Northeast of Unimak Island, 24 fathoms, station 3266.

Northwest of Unimak Island, 43 fathoms, station 3262.

Unimak Pass, 34 fathoms, station 3220.

Off North Head, Akutan Island, 72 fathoms, station 2842.

Off south entrance to Akutan Pass, 45 fathoms, station 2843.

Off Aektok Island, 54 fathoms, station 2844.

Davidson Bank, 42 fathoms, station 2845.

North of Unalaska, 350 fathoms, station 3331.

Iliuliuk Harbor, 93 fathoms, station 3335.

Off Makushin Bay, Unalaska, 61 fathoms, station 3318.

Southwest of Sannak Islands, 41 fathoms, station 3213.

15 miles south of Sannak Islands, 44 fathoms, station 2846.

Off Shumagin Bank, 138 fathoms, station 3339.

Off Falmouth Harbor, Shumagins, 48 fathoms, station 2847.

Shumagins, 21–58 fathoms, stations 2850–2852.

Off Trinity Islands, 159 fathoms, station 2853.

Admiralty Inlet, Puget Sound, 40 fathoms, station 2865.

Washington Sound, Strait of Fuca, 48 fathoms, station 2864 (type locality).

Strait of Fuca, 40–152 fathoms, stations 3443–3446, 3451, 3454, 3455, 3458, 3459, 3461, 3462, 3464, 3465, 3596.

Dr. W. H. Dall has collected the species at 16 localities along the Aleutian Islands and eastward to Port Etches in 3–80 fathoms.

SPIRONTOCARIS MURDOCHI Rathbun.

Plate III, fig. 6.

Hippolyte spinus MURDOCH, Report Internat. Polar Exped. to Point Barrow, Alaska, 140, 1885. Not *Cancer spinus* Sowerby.

Spirontocaris murdochi RATHBUN, Proc. U. S. Nat. Mus., XXIV, 893, 1902.

Very near *S. liljeborgii* and *S. spina*.

Female stout. Rostrum three fourths as long as carapace, not reaching tip of antennal scale. Carapace cristate, except on posterior fourth, and furnished with 3 or 4 large teeth. Midrib of rostrum nearly horizontal; tip acute; upper limb with convex upper margin, armed with 20 or 22 small irregular teeth; lower limb, also with convex margin, deeper than the upper, and furnished with 1 to 4 small teeth near the extremity.



FIG. 21. *Spirontocaris murdochi*. Side of carapace of ♀ (X 1½). Station 3650.

Two supraorbital spines, one antennal, and one pterygostomian spine, all well developed.

Eyes of moderate size, slightly pyriform, the width of antennular peduncle and half its scale. Antennular peduncle extending three fifths the length of the antennal scale; second segment twice as long as third; basal scale reaching nearly to end of second segment; thickened portion of outer flagellum reaching about to tip of antennal scale. Antennal peduncle reaching slightly beyond the first segment of the antennular peduncle; scale narrow-ovate, about as long as the rostrum, its spine reaching about as far forward as the blade.

Outer maxillipeds rather broad and reaching nearly to tip of acicle. First pair of feet extending a little beyond antennal peduncle, the second pair beyond acicle, fifth pair nearly to tip of maxilliped; dactyli of last three pairs long and slender, that of last pair half as long as propodus.

Abdomen not carinate; third segment produced well backward; fourth provided with a lateral spine; sixth three fourths as wide as long, and about three fifths as long as the seventh, which has 3 pairs of lateral spinules.

Male.—The male differs from the female in the same manner as in *S. liljeborgii*; it is smaller and slenderer than the female, rostrum and antennules longer, dorsal teeth much reduced.

Dimensions.—♀, length 46.6 mm., length of carapace and rostrum 17 mm., of rostrum 7.5 mm.

Distribution.—Arctic coast of Alaska; Kamchatka; Okhotsk Sea. Rare. Taken at the following localities:

Lat. 71° 02' 00" N., long. 157° 46' 00" W., 19 fathoms, 1 ♂ (U. S. R. S. Corwin).

10 miles west of Point Franklin, 13½ fathoms, 3 ♂ (Point Barrow Expedition).

Off Cape Sabine, 12 fathoms, 1 ♀ (W. H. Dall).

15 miles off Cape Krusenstern, 14 fathoms, 1 ♀ (W. H. Dall).

Rakovaya Bay, Avacha Bay, Kamchatka, 1 ♀ (*Albatross*).

Off Robben Island, east coast of Sakhalin, Okhotsk Sea, 28 fathoms, 1 ovigerous ♀, type (*Albatross* station 3650).

The species differs from *S. liljeborgii* in its lower carapace, shorter (in the ♀) and less ascending rostrum, smaller eyes, shorter spine of antennal scale (in *S. liljeborgii* the spine extends considerably beyond the blade), longer dactyli of third to fifth pairs of feet, longer abdomen, and stouter sixth segment. From *S. spina* it differs in the lower carapace and less ascending rostrum, in the lesser advancement of the lower limb of the rostrum, smaller eyes, shorter spine of scale, shorter and broader lobe of third abdominal segment, which is not carinated, longer dactyli of third to fifth pairs of feet (in *S. spina* the dactylus of the fifth pair is only one third length of propodus).

SPIRONTOCARIS TRUNCATA Rathbun.

Spirontocaris truncata RATHBUN, Proc. U. S. Nat. Mus., XXIV, 894, 1902.

Allied to *S. spina*. Median carina extending nearly to the posterior margin of the carapace, convex, and armed with 4 spines. Rostrum subtriangular, widest at the extremity, about three fifths as long as the carapace, reaching end of second antennular segment, midrib curving upward as in *S. spina*, upper margin with 1 spine at its middle, extremity with 7 spines, 2 above and 4 below the midrib. Supraorbital spines 2, equal, large, one behind the other but scarcely above it, well separated. Anterior margin with 2 spines below the orbit as in *S. spina*.



FIG. 22. *Spirontocaris truncata*. Side of carapace of ♂ (X 61). Station 2886.

Antennular acicle reaching beyond the anterior margin of the second segment but not so far as the slender spine at the outer angle of that margin; a small spine at the middle of the anterior margin of the third segment. Antennal acicle tapering, narrow at the end, reaching one third the length of the thick antennular flagellum. Peduncle reaching beyond first segment of antennular peduncle; flagellum two thirds as long as body.

Maxillipeds reaching end of antennal scale; first pair of feet to end of antennal peduncle. The propodi of the third, fourth, and fifth pairs are three times as long as their dactyli.

Margins of first to third abdominal segments entire; of fourth to sixth

segments with a spine at the lower postero-lateral angle; sixth segment less than twice as long as fifth, and only a trifle longer than wide. Telson with four pairs of lateral spinules.

Dimensions.—♂, length 14 mm.

Type locality.—Heceta Bank, Oregon, 50 fathoms (*Albatross* station 2886); one specimen.

Aside from the peculiar form of the rostrum, this species differs notably from *S. spina* in its subequal and more widely separated supra-orbital spines. Its habitat is also farther south than the known range of *S. spina*.

SPIRONTOCARIS LILJEBORGII (Danielssen).

Hippolyte Liljeborgii DANIELSSEN, *Nyt Mag. for Naturvid.*, XI, 5, 1859 (brief description; Vol. XI appeared in 1861, but the separate containing Danielssen's article was issued in 1859).—DANIELSSEN and BOECK, *Nyt Mag. for Naturvid.*, XIX, 196 [8], plate, figs. 15–20, 1872.

Hippolyte securifrons NORMAN, *Brit. Assoc. Adv. Sci.* for 1861, XXXI, 151 (1862); *Trans. Tyneside Naturalists' Field Club*, V, 267, pl. XII, figs. 1–7, 1863.—SMITH, *Trans. Conn. Acad. Arts Sci.*, V, 69, 1879.

Distribution.—East of Point Franklin, Arctic Alaska (lat. $71^{\circ} 02' 00''$ N., long. $157^{\circ} 46' 00''$ W.), 19 fathoms, August 24, 1884, one small male (U. S. R. S. *Corwin*). Known from the Atlantic coast of America, from off Nova Scotia to Delaware Bay, 27–452 fathoms; northern Europe.

SPIRONTOCARIS BISPINOSA Holmes.

Spirontocaris bispinosa HOLMES, *Occas. Papers Calif. Acad. Sci.*, VII, 207, 1900. Puget Sound.



FIG. 23. *Spirontocaris bispinosa*. Side of carapace of ♀ (X 2). Station 2935.

Dimensions.—Ovigerous ♀, length (approximate) 59.5 mm., length of carapace and rostrum 25.2 mm., of rostrum 14.8 mm.

Distribution.—From Strait of Fuca to off San Diego, California,

13–211 fathoms. Taken by the *Albatross* at:

Strait of Fuca, 116 and 98 fathoms, stations 3447, 3448.

Puget Sound, 82 fathoms, station 3067.

Off Tahwhit Head, Washington, 178 fathoms, station 3076.

Off Tillamook Rock, Oregon, 29 fathoms, station 2882.

Off Bodega Head, California, 167 and 62 fathoms, stations 3170, 3172.

Off Farallone Islands, California, 191 fathoms, station 3161.

Monterey Bay, 13–68 fathoms, stations 3132, 3134, 3666.

Off Lobos Rocks, 77 fathoms, station 3184.

Off San Simeon Bay, 211 and 160 fathoms, stations 3191, 3193.

Off Esteros Bay, 92 fathoms, station 3194.

Southwest of San Nicholas Island, 158 fathoms, station 2898.
Off San Diego, 124 fathoms, station 2935.

SPIRONTOCARIS SNYDERI Rathbun.

Spirontocaris snyderi RATHBUN, Proc. U. S. Nat. Mus., XXIV, 894, 1902.

This species bears a curious resemblance to *S. bispinosa*; in general terms it is a *bispinosa* with the slender spine of the rostrum broken off; but a closer examination shows other and more radical differences. The specimens, among which are several egg-bearing females, are all smaller than *S. bispinosa*, but this is not absolute proof that the species is smaller, because the females of *S. bispinosa* are fertile when rather small.



FIG. 24. *Spirontocaris snyderi*. Side of carapace of ♀ (X 24). Station 2886.

The median spines of the carapace proper are 3 or 4, instead of 2, as in *S. bispinosa*, and are larger; the last spine is at the posterior two fifths of the carapace. Between these spines and the small ones on the rostrum there is a considerable space. The rostral teeth are 5 or 6 above, 3 or 4 below. The rostrum is a little shorter than the carapace and is much the shape of that of *S. bispinosa*, excepting that the midrib is more rapidly ascending and ends in a short point in front of the laminae, and the upper lamina is shallower and of rather even depth throughout its length.

The antennal peduncle reaches only about a third the length of the scale, in *S. bispinosa* half the length of the scale. The first pair of chelipeds reach the end of the antennal peduncle; in *S. bispinosa* they are shorter. The dactyls of the third, fourth, and fifth pairs of feet, which are very long in *S. bispinosa* (about half as long as the propodi), are in *S. snyderi* a third, or less than a third, as long as their propodi.

Dimensions.—Ovigerous ♀, length (approximate) 28 mm., length of carapace and rostrum 9.4 mm., of rostrum 4.4 mm.

Distribution.—From Puget Sound to Lower California, as follows:

Puget Sound (T. Kincaid).

Heceta Bank, Oregon, 50 fathoms (*Albatross* station 2886).

Monterey Bay, California, type locality (J. O. Snyder).

Near Lobos Rocks, 77 fathoms (*Albatross* station 3184).

Off Santa Catalina Island, 47 fathoms (*Albatross* station 3663).

Southern California (W. H. Dall).

Off Cerros Island, Lower California, 44 fathoms (*Albatross* station 2838).

SPIRONTOCARIS SICA Rathbun.

Spirontocaris sica RATHBUN, Proc. U. S. Nat. Mus., XXIV, 894, 1902.

Allied to *S. bispinosa*, but inhabiting deeper water on the coast of California. Differs as follows: The teeth of the dorsal carina begin

considerably in front of the middle of the carapace (exclusive of rostrum); in *S. bispinosa* they begin at or a little posterior to the middle.



FIG. 25. *Spirontocaris sica*. Side of carapace of ♀ (× 12). Station 3200.

Rostrum shorter; the upper and lower laminae are narrower and extend nearer the tip; there are 9 to 14 superior teeth (in *S. bispinosa* 10 to 12), of which two are on the carapace; 3 to 5 inferior teeth on the lamina (the same in *S. bispinosa*), but none on the slender terminal portion.

The second segment of the antennular peduncle is longer than in *S. bispinosa*, being three times as long as the third segment, while in *S. bispinosa* it is twice as long. The outer maxillipeds are longer, reaching beyond the antennal scale; in *S. bispinosa* they do not reach the end of the scale. The thoracic feet are longer and slenderer, the first pair overreaching the antennular peduncle; in *S. bispinosa* they fall short of the peduncle. The last pair exceed the antennal scale by the length of the dactylus and one half the propodus; in *S. bispinosa*, by the length of the dactylus only.

Dimensions.—♀, length 58 mm., length of carapace and rostrum 24.8 mm., of rostrum 12.8 mm.

Type locality.—Santa Barbara Channel, California, 265 fathoms (*Albatross* station 3200).

Distribution.—Off the coast of California, from Point Arena to San Diego, in 211–464 fathoms, at 19 stations of the *Albatross*.

SPIRONTOCARIS PHIPPSII (Krøyer).

Hippolyte Phippsii KRØYER, Naturh. Tidssk., III, 575, 1841 (♂); K. Danske Vidensk. Selsk. Afhand., IX, 314, pl. III, figs. 64–68, 1842 (♂).

Hippolyte turgida KRØYER, Naturh. Tidssk., III, 575, 1841 (♀); K. Danske Vidensk. Selsk. Afhand., IX, 308, pl. II, figs. 57, 58, and pl. III, figs. 59–63, 1842 (♀).

Hippolyte vibrans STIMPSON, Ann. Lyc. Nat. Hist. N. Y., X, 125, 1871 (♂).

Female.—Posterior spine of dorsal crest at about the middle of the carapace; 7 to 12 dorsal spines, which diminish on the rostrum; 3 or 4 on carapace. Midrib of rostrum slightly inclined upward, nearly straight; upper limb diminishing gradually in depth toward the tip; lower limb deeper than the upper, triangular, 4 to 7 spines on distal half; tip acute, reaching a little beyond the peduncle of the antennula. On the anterior portion of the carapace are 2 supraorbital spines, one above and a little behind the other, the lower smaller; an antennal spine; and a well-developed pterygostomial spine.

The antennular scale reaches the end, or nearly the end, of the second

segment of the peduncle; the eye extends to the second segment, which, as well as the third, is very short. The antennal peduncle falls short of the middle of the scale; scale short and broad, subequal in length to the rostrum.

The maxillipeds exceed the antennal scale a little. The palm of the first pair of feet overlaps the last segment of the maxillipeds. The last three pairs of feet are rather stout, and the last pair exceeds the antennal peduncle a little.

Abdomen conspicuously punctate.

Male.—The rostrum is horizontal or deflexed, and very slender, and the spines are small and appressed. Peduncles of antennulæ more elongate than in the ♀, eyes not reaching end of first segment, basal scale extending to middle of second segment.

Dimensions. — Ovigerous ♀ : length (approximate) 37.5 mm., length of carapace and rostrum 13 mm., of rostrum 5.3 mm.

Distribution.—Arctic Alaska to the Shumagins; 6–72 fathoms. Circumpolar. Atlantic coast of America southward to Cape Cod; 8–125 fathoms. Northern Europe.

In the collections of the U. S. National Museum are specimens obtained by Dr. W. H. Dall at various localities along the Aleutian Islands eastward to the Shumagins, in 6–30 fathoms; in Bering Strait, 13–17 fathoms; and in Plover Bay, Siberia, 10–25 fathoms.

Taken by the *Albatross* at the following stations:

Pumicestone Bay, 35 fathoms, station 3322.

Off North Head, Akutan Island, 72 fathoms, station 2842.

Unimak Pass, 34 fathoms, station 3220.

North of Bird Island, Shumagins, 21 fathoms, station 2850.

10 miles west of Point Franklin, Alaska, 13½ fathoms (Point Barrow Expedition).

Lat. 71° 02' 00" N., long. 157° 46' 00" W., 19 fathoms (U. S. R. S. *Corwin*).

Off Point Hope, Alaska, 25 fathoms (U. S. R. S. *Corwin*).

SPIRONTOCARIS OCHOTENSIS (Brandt).

Hippolyte ochotensis BRANDT, Middendorff's Reise Sibir., band II, Zool., Theil I, Krebsc, p. 120, pl. v, fig. 17, 1851.

Dorsal crest arising at about the middle of the carapace; 3 large spines on the carapace. Rostrum reaching to end of antennular peduncle; midrib ascending in its terminal portion; upper lamina convex above, tapering forward and backward, armed with about 6 or 7 small spines distant from those on the carapace; tip usually bifid; lower lamina deep, subtriangular, armed with 4 or 5 small spines on the anterior

half. Two spines above the eye, the posterior one above and much larger than the anterior.

Outer spine of antennula reaching the end of the second segment or a little beyond it; flagella reaching only a little beyond antennal scale. Scale broad, about two thirds as long as carapace. The maxillipeds reach a little beyond the antennal scale. The palms of the first pair of feet extend to the last segment of the maxillipeds. The last 3 pairs of



Spirontocaris ochotensis. Side of carapace of ♀ (× 18). Port Moller.

feet are stoutish, the last pair scarcely reaching the end of the antennal peduncle.

The telson is a little more than one and a half times as long as the sixth segment, and is armed with 4 pairs of lateral spinules.

In the males the carapace is flatter, the rostrum more horizontal, less upturned.

Dimensions. — ♀, length 40 mm., length of carapace and rostrum 13.5 mm., of rostrum 5.6 mm.

Distribution. — Bering Sea to Sitka; Kamchatka; Okhotsk Sea; Japan.

Taken by W. H. Dall at 14 stations from Nunivak southward and along the Aleutian Islands and Alaska Peninsula to Sitka, 5–20 fathoms. Off Bristol Bay, $7\frac{1}{4}$ – $14\frac{3}{4}$ fathoms (*Albatross* stations 3232, 3233, 3236).

Off Kululak Bay, 15 fathoms (*Albatross* station 3300).

Lat. $63^{\circ} 50' 00''$ N., long. $167^{\circ} 21' 00''$ W., 17 fathoms (Lieutenant George M. Stoney, U. S. N.).

Sitka (Harriman Expedition).

Bering Island (L. Stejneger).

Bering Island, in stomach of *Gadus macrocephalus* (N. Grebnitzky).

Petropavlovsk, Kamchatka, 10–12 fathoms (N. Grebnitzky).

Okhotsk Sea (Brandt).

Hakodate Bay, Japan (Stimpson).

SPIRONTOCARIS DALLI Rathbun.

Spirontocaris dalli RATHBUN, Proc. U. S. Nat. Mus., XXIV, 894, 1902.

Female.—Allied to *S. ochotensis*, from which it is separated by few but well-marked characters. The rostrum is longer than in *S. ochotensis*, reaching nearly to the end of the antennal scale; the midrib is straighter, less sinuous, and terminates in a single sharp spine; the teeth on the rostrum are 6–8 above, 3–4 below. The carapace is lower. The last 3 pairs of thoracic feet are longer and more slender. The sixth segment of the abdomen is also longer than in *S. ochotensis*, being more than one and a half times as long as the fifth segment.

Male.—As compared with the female, the teeth of the median carina and rostrum are much smaller and more appressed, sometimes obsolescent, the rostrum less deep and more horizontal; the antennular acicle does not reach the end of the second segment of the peduncle; the spine of the antennal scale falls short of the end of the blade.

Dimensions. — ♀, length (approximate) 38 mm., length of carapace and rostrum 13.6 mm., of rostrum 6 mm.

Distribution.—Arctic Alaska, Aleutian Islands to Sitka.

Although this species appears to be not rare in Alaska, it has been collected almost exclusively by Dr. Dall, who obtained it at 17 stations along the Aleutian Islands and eastward to Port Etches, 6–20 fathoms; off Cape Sabine, 13 fathoms; and 15 miles off Cape Krusenstern, 14 fathoms.

Sitka, 2 specimens (Harriman Expedition, W. R. Coe, collector).

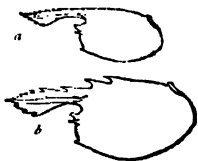


FIG. 27. *Spirontocaris dalli* (× 2½). Attu.

a. Side of carapace of ♂.
b. Side of carapace of ♀.

SPIRONTOCARIS POLARIS (Sabine).

Alpheus polaris SABINE, Supplement to Appendix of Parry's [First] Voyage, p. ccxxxviii, pl. 11, figs. 5–8, 1824.

Hippolyte borealis JAMES C. ROSS, in John Ross, Appendix to Narrative of Second Voyage in Search of a North-West Passage, p. lxxxiv, pl. B, fig. 3, 1835 (♂).

Hippolyte polaris JAMES C. ROSS, *op. cit.*, p. lxxxv (♀).

Hippolyte St. Pauli BRANDT, Middendorff's Reise Sibir., band 11, Zool., Theil 1, Krebse, p. 118, pl. v, fig. 19, 1851.

Hippolyte cultellata NORMAN, Rept. Brit. Assoc. Adv. Sci., 1866, p. 200 (1867) (= *H. polaris*, teste Norman, Museum Normanianum, 111, Crustacea, p. 8, 1886).

Hippolyte polaris SMITH, Trans. Conn. Acad. Arts Sci., v, p. 80, pl. XI, figs. 1–4, 1879.

Hippolyte Amazo PFEFFER, Jahrb. Hamburg. Wiss. Anst., 111, 46, plate, figs. 7a, 7b, 1886.

Hetairus gaimardii BATE, Challenger Rept., Zool., xxiv, 611, pl. CIX, fig. 2, 1888 (not *Hippolyte gaimardii* Milne Edwards).

Hetairus tenuis BATE, *op. cit.*, 613, pl. CIX, fig. 3.

Hetairus debilis BATE, *op. cit.*, 615, pl. CIX, fig. 4.

Professor Smith (*loc. cit.*) sets forth the variations in the sexes, in the number of rostral spines, and in the aculei on the telson. He states that "the disappearance of the dorsal teeth of the rostrum is evidently a character peculiar to, but not characteristic of, the adult male." In the series of specimens from the North Pacific and Bering Sea this is not the case, as the majority of the females from those localities are devoid of superior rostral teeth. This series also exhibits other variations. The body and thoracic feet are usually stouter, the antennal scale shorter and

broader, the antennular scale, on the contrary, commonly longer than in Atlantic forms, in the ♀ often reaching the end of the peduncle, and in the ♂ sometimes the end of the second segment. There is, however, a lack of constancy in these characters which prevents the separation of the stout form as a distinct species; it was described by Brandt as *H. St. Pauli*. Again, the rostrum may be only as long as the peduncle of the antennula, or reach nearly to the end of the antennal scale; it may be of greater or less depth and acuteness. From the variations at a single locality, Bate (*loc. cit.*) described three species for which he constructed the genus *Hetairus*.

Distribution.—Circumpolar. Atlantic coast of North America southward to Cape Cod, 10–218 fathoms. Northern Europe. Bering Sea, Okhotsk Sea, Aleutian Islands eastward to Kadiak, to a depth of 283 fathoms:

Taken by the *Albatross*:

Off Pribilof Islands, 25 fathoms, station 3558.

Off Rat Islands, Aleutians, 55 fathoms, station 3599.

Off Seguam, Aleutians, 283 fathoms, station 3480.

Pumicestone Bay, 35 fathoms, station 3322.

Northwest of Unimak Island, 41 and 43 fathoms, stations 3259, 3262.

Northeast of Cape Leontovich, 22 fathoms, station 3275.

Okhotsk Sea, 10 fathoms, station 3645.

Collected by Dr. W. H. Dall at:

Plover Bay, East Siberia, 10–25 fathoms.

Near Indian Point, Bering Strait, 17 fathoms.

Various localities along the Aleutian Islands eastward to Kadiak, 3–80 fathoms.

St. Paul Island, Pribilofs (William Palmer).

Bering Island (L. Stejneger).

Bering Island, among *Laminaria* (N. Grebnitzky).

SPIRONTOCARIS UNALASKENSIS Rathbun.

Spirontocaris unalaskensis RATHBUN, Proc. U. S. Nat. Mus., XXIV, 895, 1902.

Female.—Body rather robust. Carapace carinated in its anterior half; posterior median spine situated at the anterior third of the carapace. Rostrum longer than the carapace or the antennal scale, nearly horizontal,



FIG. 28. *Spirontocaris unalaskensis*. Side of carapace of ♀ (× 1½). Station 3332.

but slightly concave above, dorsal spines 4 or 5, equally spaced, 2 on the carapace and 2 or 3 at base of rostrum; no upper limb on distal portion, lower limb shallow, convex, armed with three

spines in front of middle, tip acuminate, sometimes minutely bifid. Anterior margin of carapace armed with 3 spines, one supraorbital, one antennal, and one smaller, pterygostomian. Eyes large, pyriform.

First two segments of antennules with an antero-external spine, third segment less than half as long as the second and armed with a spine at the middle of its anterior upper margin; the scale at outer base overreaches the first segment. Outer flagellum reaching but little beyond the rostrum; inner flagellum twice as long.

Antennal peduncle extending nearly to the end of the second segment of the antennular peduncle. Scale oblong, tapering, shorter than the carapace, tipped with a small spine which is exceeded by the blade. Flagellum at least two thirds as long as the body.

Tip of maxilliped intermediate between rostrum and antennal scale. Carpal joint of first pair of feet reaching end of antepenult segment of maxilliped. Second and fifth pairs of feet reaching about to end of rostrum.

Abdomen ecarinate, third segment very prominent, its hinder portion extending well behind the line of the fourth segment. The sixth segment is about one and two thirds as long as the fifth, and seven ninths as long as the telson, which is armed with 5 or 6 spinules on each side.

Dimensions.—A female, soft shell, measures about 79 mm. in length; a smaller female is 60 mm. long, carapace and rostrum 26.5 mm., rostrum 14.5 mm.

Distribution.—North of Unalaska, 277–351 fathoms, *Albatross* stations 3315, 3330, 3331 (type locality).

Variations.—In the male the rostrum is slenderer and more sinuous, the antennal flagella considerably longer. In small specimens the rostrum is relatively shorter.

SPIRONTOCARIS VICINA Rathbun.

Spirontocaris vicina RATHBUN, Proc. U. S. Nat. Mus., XXIV, 895, 1902.

Allied to *S. unalaskensis*.

Female.—Posterior dorsal spine at anterior third of carapace. Rostrum longer than the carapace or antennal scale, concave above, dorsal spines 7 or 8, of which two are on the carapace, the anterior not very near the tip, inferior spines 4, tip broken off in our specimens. Anterior margin 3-spined, the pterygostomian spine the smallest. Eyes large, pyriform.



FIG. 29. *Spirontocaris vicina*. Side of carapace of ♀ (X 12). Station 3316.

The antennular peduncles reach nearly to the spine of the antennal

scale; the second segment is about three times as long as the third; the basal scale falls considerably short of the second joint of the peduncle. The antennal peduncle does not reach the middle of the second segment of the antennular peduncle; scale similar to that of *S. unalaskensis*.

Abdomen like that of the preceding species. The telson is incomplete in all the females.

Male.—In the single male, the rostrum is a little shorter than the carapace and does not reach the end of the antennular peduncle; it is also straighter than in the female, and is armed with 6 spines above and 3 below.

Dimensions.—A female with rostrum and telson broken measures 39 mm. from the orbit to the end of the sixth abdominal segment. A female about the same size, in very bad shape, is laden with eggs, each about 3 mm. in its greatest diameter. Male, length 50 mm., length of carapace and rostrum 18.5 mm., of rostrum 8.5 mm.

Distribution.—North of Unalaska, 309–406 fathoms, stations 3316 (type locality), 3330, 3332.

SPIRONTOCARIS WASHINGTONIANA Rathbun.

Spirontocaris washingtoniana RATHBUN, Proc. U. S. Nat. Mus., XXIV, 895, 1902.

Female.—Carapace stout, carinated in its anterior half; posterior median spine situated at the anterior fourth of the carapace. Rostrum slender, half as long as the carapace, reaching just to the end of the first segment of the antennules, nearly horizontal, slightly sinuous; dorsal spines 4, two of which are on the carapace, anterior two fifths of rostrum unarmed above; 3 teeth below on anterior third, one tooth close to the tip; except for the teeth, the rostrum is scarcely limbed above or below.



FIG. 30. *Spirontocaris washingtoniana*. Side of carapace of ♀ (X 24). Station 3071.

Anterior margin armed with 3 spines, one supraorbital, one antennal, one smaller at the antero-lateral angle.

Antennular peduncles reaching nearly to the base of the spine of the antennal scale; first segment with a large bifurcate spine on the anterior margin toward the outer angle; second segment with a long simple spine in the same position; third segment with a small dorsal spine at the middle of its anterior margin; the first segment is about twice as long as the second, the second three times as long as the third; the flagella are subequal in length, and half again as long as the peduncle; scale about two thirds as long as first segment. The antennal scale is two thirds as long as the carapace, oblong-lanceolate, extremity of blade

oblique and exceeding the spine; the peduncle attains the middle of the scale; flagellum about as long as the body.

The maxilliped extends beyond the antennal scale by half the length of its last segment; the first pair of feet just reaches the end of the antennal scale, the second pair extends a little beyond the maxilliped, the fifth pair not quite so far as the maxilliped. Second to fifth pairs very slender.

The abdomen is narrow compared with the carapace; the posterior margin of the third segment is moderately produced; the sixth segment is one and a half times as long as the fifth, and a little more than one half as long as the seventh; this last has 5 or 6 spinules on either side.

Dimensions.—♀, length 39 mm., length of carapace and rostrum 14 mm., of rostrum 5 mm. A mutilated specimen of the same size is ovigerous.

Type locality.—Off Sea Lion Rock, Washington, 685 fathoms (*Albatross* station 3071).

SPIRONTOCARIS AFFINIS (Owen).

Hippolyte affinis OWEN, in Zoology of Capt. Beechey's Voyage [of the *Blossom*], Crustacea, p. 90, pl. XXVII, fig. 4 (rostrum).

Locality.—Monterey, California (Owen).

SPIRONTOCARIS GRACILIS (Stimpson).

Hippolyte gracilis STIMPSON, Proc. Acad. Nat. Sci. Phila., 1864, 155.

Heptacarpus tenuissimus HOLMES, Occas. Papers Calif. Acad. Sci., VII, 203, 1900.

Heptacarpus? gracilis HOLMES, *op. cit.*, p. 205.

Distribution.—From the Shumagins, Alaska, to Monterey, California: North of Bird Island, Shumagins, 21 fathoms (*Albatross* station 2850).

Off Cape Beale, Vancouver Island, British Columbia, 34 fathoms (*Albatross* station 2879).

Off Cape Flattery, Washington, 40 fathoms (*Albatross* station 2873).

Off Drake Bay, California, 35 fathoms (*Albatross* station 3155).

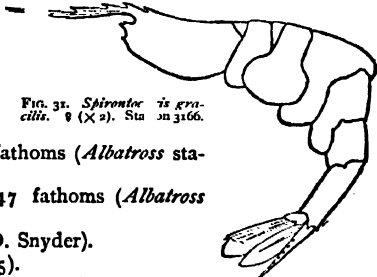
Off Point Reyes, California, 47 fathoms (*Albatross* station 3166).

Monterey Bay, California (J. O. Snyder).

Puget Sound (T. Kincaid, 1895).

Puget Sound, deep water (Stimpson); Monterey (Holmes).

FIG. 31. *Spirontocaris gracilis*. ♀ (× 2). Sta 3166.



On the few specimens examined the superior teeth are 4; the inferior vary from 4 to 8.

Stimpson says that the thick flagellum of the antennulæ extends to the end of the rostrum; this is probably true of the ♂. All the specimens in hand are females, in which the flagellum extends only about two thirds the length of the rostrum.

Dimensions.—Approximate length of ♀ with eggs 48.4 mm., length of carapace and rostrum 18 mm., of rostrum 10.5 mm.

SPIRONTOCARIS FLEXA Rathbun.

Spirontocaris camtschatica RATHBUN, The Fur Seals and Fur-Seal Islands of the North Pacific Ocean, pt. III, 557, 1899. Not *S. camtschatica* (Stimpson).

Spirontocaris flexa RATHBUN, Proc. U. S. Nat. Mus., XXIV, 896, 1902.

Female.—Slender. Carapace crested on its anterior third; rostrum longer than the carapace, armed with 4 or 5 teeth above, including 1 or 2 on the carapace; anterior tooth near middle of rostrum; anterior half of rostrum not limbed above. Rostrum very slender, nearly horizontal, a

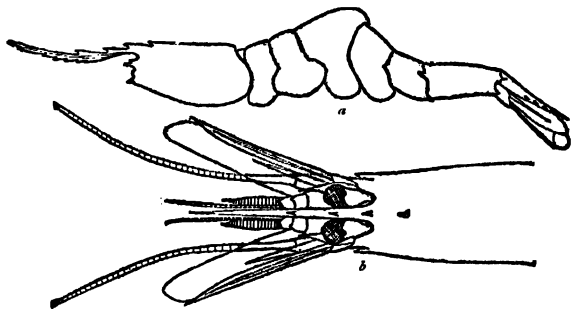


FIG. 32. *Spirontocaris flexa*. ♀. Station 2850. a. Side of carapace and abdomen (× 2). b. Dorsal view of anterior portion (× 3).

little arched above the eye; lower limb narrow and armed with from 5 to 8 spines; tip reaching nearly to or a little beyond the end of the antennal scale. An antennal and a pterygostomial spine, the latter well developed.

Antennular peduncle reaching one third the length of the antennal scale; basal spine to a little beyond first segment; thickened portion of outer flagellum reaching to about distal third of antennal scale; inner flagellum to end of scale. Spine of antennal scale not nearly as advanced as the membranous portion. Peduncle of antenna advanced as far as the second antennular segment; flagellum nearly as long as body.

Maxillipeds produced to about middle of antennal scale; first pair of feet to end of antennal peduncle; second pair to a little beyond the maxillipeds; the last pair of feet to the end of the maxillipeds.

The abdomen is strongly geniculated or bent at a right angle at the third segment, which is posteriorly produced and compressed, forming a smooth, rounded carina. The first to fourth segments are without spines or spinules; the sixth is more than twice as long as wide, but shorter than the seventh, which is narrow and has 4 spinules on each side.

Male.—The thickened portion of the outer antennular flagellum extends nearly to the end of the antennal scale.

This species is very near *S. gracilis*, from which it differs in the longer basal scale of the antennula, in the lower position of the pterygostomial spine, in the presence of epipods on the maxilliped and first two pairs of feet.

Dimensions.—♀, length 54 mm., of carapace and rostrum 20 mm., of rostrum 11.5 mm.

Distribution.—From Bering Sea to Drake Bay, California:

Bering Island, one specimen from stomach of *Gadus macrocephalus* (N. Grebnitzky).

Alaska, probably Bering Sea (U. S. R. S. *Corwin*).

Nazan Bay, Atka (W. H. Dall).

Albatross stations:

Off Pribilof Islands, 20 fathoms, station 3438.

Off Rat Islands, Aleutians, 55 fathoms, station 3599.

Iliuliuk Harbor, Unalaska, 93 fathoms, station 3335.

Off North Head, Akutan Island, 72 fathoms, station 2842.

Off south entrance to Akutan Pass, 45 fathoms, station 2843.

Unimak Pass, 34 and 50 fathoms, stations 3220, 3222.

Northwest of Unimak Island, 43 fathoms, station 3262.

South of Unimak Island, 42 fathoms, station 3217.

15 miles south of Sannak Islands, 44 fathoms, station 2846.

Shumagins, 21–58 fathoms, stations 2850 (type locality), 2851, 2852.

Drake Bay, California, 35 fathoms, station 3155.

SPIRONTOCARIS AMABILIS (Lenz).

Hippolyte amabilis LENZ, Zool. Jahrb., Syst., XIV, 432, pl. XXXII, figs. 2, 3, 1901.

Bare Island, British Columbia (type locality).

SPIRONTOCARIS DECORA Rathbun.

Spirontocaris decora RATHBUN, Proc. U. S. Nat. Mus., XXIV, 896, 1902.

Female.—Carapace crested on its anterior half; rostrum longer than the carapace, armed with 4 or 5 teeth above, of which one or two are on

the carapace, the anterior tooth in front of the middle of the rostrum. Rostrum not deep, but less slender than in *S. gracilis* and *S. flexa*, a little concave above, but nearly horizontal; lower limb narrowing distally from near

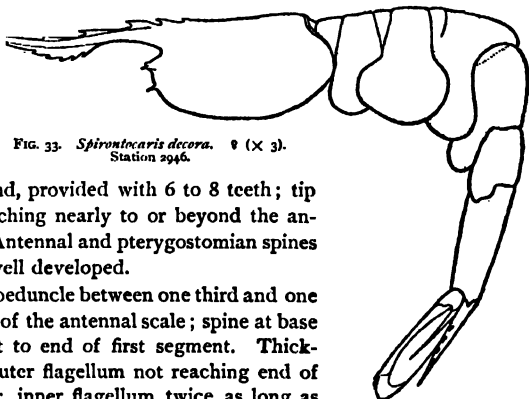


FIG. 33. *Spirontocaris decora*. ♀ (X 3).
Station 2946.

the posterior end, provided with 6 to 8 teeth; tip acuminate, reaching nearly to or beyond the antennal scale. Antennal and pterygostomian spines present, both well developed.

Antennular peduncle between one third and one half the length of the antennal scale; spine at base reaching about to end of first segment. Thickened part of outer flagellum not reaching end of antennal scale; inner flagellum twice as long as outer. Outer margin of antennal scale as long as the carapace; peduncle extending as far as the end of the second antennular segment. Maxillipeds extending beyond middle of antennal scale.

The posterior margin of the third abdominal segment is produced backward in the middle, and the segment itself is posteriorly prominent but not laterally pinched or carinated as in allied species. The sixth segment is more than twice as long as wide, and a little longer than the seventh, which has 5 to 7 pairs of lateral spinules, and is shorter than the uropods.

Male.—The thickened part of the outer flagellum of the antennula extends to the end, or nearly to the end, of the antennal scale; the inner flagellum is correspondingly long.

Dimensions.—Approximate length of ♀ 47 mm., length of carapace and rostrum 16.4 mm., of rostrum 9 mm.

Distribution.—From Strait of Fuca to San Diego, California; 50 to 171 fathoms. Dredged by the *Albatross* at the following stations:

Strait of Fuca, 152, 114 fathoms, stations 3454, 3461.

Near Flattery Rocks, Washington, 171 fathoms, station 2866.

Heceta Bank, Oregon, 50 fathoms, station 2886.

Off Point Conception, California, 145 fathoms, station 2893.

Off Santa Cruz Island, California, 150 fathoms, station 2946 (type locality).

Off Santa Rosa Island, California, 52 fathoms, station 2956.

Off San Diego, California, 124 fathoms, station 2935.

SPIRONTOCARIS TRIDENS Rathbun.

Spirontocaris tridens RATHBUN, Proc. U. S. Nat. Mus., XXIV, 896, 1902.

Allied to *S. gracilis*, *S. flexa*, and *S. decora*, but more robust than these.

Female.—The median crest occupies the anterior third of the carapace; superior spines or teeth 3, one on the carapace, one (the largest and highest) over the base of the eye-stalk and nearer to the anterior than to the posterior tooth. In front of the teeth the rostrum has almost no upper limb and is gently ascending and slightly curved; midrib rather stout and acute at tip; the lower limb diminishes anteriorly and is armed

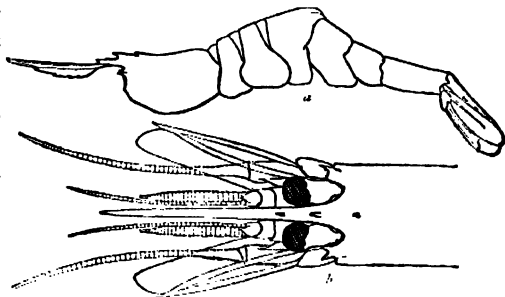


FIG. 34. *S. tridens*. *a.* Side of carapace and portion of abdomen ($\times 14$). *b.* Dorsal view of carapace and portion of abdomen ($\times 3$).

with 3 to 6 teeth, one near the tip. Rostrum longer than the carapace or antennal scale. Anterior margin of carapace furnished with a strong antennal and a very small pterygostomian spine.

Antennular peduncle extending two fifths the length of the antennal scale; second and third segments short and subequal; basal scale with a spine which extends nearly to the end of the second segment. The thickened portion of the outer flagellum reaches nearly to the end of the antennal scale; inner flagellum twice as long. The antennal peduncle extends a little beyond the end of the second antennular segment; the flagellum is nearly as long as the body; the scale, measured along its outer margin, is a little shorter than the carapace.

The maxillipeds reach two thirds the length of the antennal scale; the first pair of feet barely to the end of the antennal peduncle. The tip of the second pair when extended lies between the end of the maxilliped and that of the antennal scale; the tip of the last pair lies between the end of the maxilliped and the antennal peduncle.

The abdomen has the third segment well produced backward, and its posterior portion carinated; the carina is defined on either side by a deep groove like the imprint of a nail. The sixth segment is more than twice as long as high, and about as long as the seventh; this last is a little

shorter than the uropods and is armed with three pairs of lateral spinules.

Male.—The thickened portion of the outer antennular flagellum reaches to the end or a little beyond the end of the antennal scale.

Dimensions.—♀, approximate length 61 mm., length of carapace and rostrum 22 mm., of rostrum 12.5 mm.

Distribution.—From the Aleutian Islands to Washington. Taken by the *Albatross* at the following stations:

Unimak Pass, 34 fathoms, station 3220.

Northeast of Amak Island, 19 fathoms, station 3274.

Northeast of Cape Leontovich, 22 fathoms, station 3275.

North of Bird Island, Shumagins, 21 fathoms, station 2850.

Off Cape Flattery, Washington, 40 fathoms, station 2873.

Strait of Fuca, 48 fathoms, stations 2864, 3465.

Admiralty Inlet, Puget Sound, 40 fathoms, station 2865 (type locality).

A single specimen was taken by Dr. Dall at Port Levashef, Unalaska, and another at Granite Cove, Port Althorp, Chichagof Island.

Variations.—Three teeth on the dorsal carina is the rule in this species; in more than two hundred specimens handled, there was one in which the anterior of the three teeth was absent, another in which the posterior tooth was absent, and two cases in which there were 4 teeth instead of 3.

Distinguished from nearly related species by the fewer dorsal teeth and by the groove on either side of the third segment of the abdomen.

SPIRONTOCARIS BARBATA Rathbun.

Spirontocaris barbata RATHBUN, The Fur Seals and Fur-Seal Islands of the North Pacific Ocean, III, 556, 1899.

Anterior two thirds of carapace carinated. Rostrum from one third to one fourth longer than the carapace, and also a little longer than the antennal scale; nearly straight and horizontal; upper limb very narrow, widening a trifle in front of eye, then diminishing to the tip, and armed with 5 to 7 spines, one of which is on the carapace; anterior tooth at about anterior third of rostrum; lower limb broader, gradually diminishing forward from a point in front of the eye, armed with about 10 to 20 teeth and denticles, of which the posterior three or four are of fair size, the remainder very small and decreasing toward the tip, where they are almost indistinguishable; tip acute. Antennal and pterygostomial spines well and equally developed, the latter unusually high in position.

Antennular peduncle reaching two fifths the length of the antennal scale; outer basal spine reaching to about the end of the first segment; second segment one and a half times as long as third; outer flagellum

not attaining end of scale, a little longer in male than in female; inner one exceeding scale. Scale oblong, nearly as long as carapace, laminar portion considerably exceeding spine; peduncle extending to the middle of the third joint of the antennular peduncle; flagellum nearly as long as body.

The maxillipeds extend to middle of antennal scale; first pair of feet nearly to end of antennal peduncle; third, fourth, and fifth pairs of nearly equal length, the third pair reaching spine on antennal scale; second pair a little shorter.

The abdomen is sharply carinated from the middle of the third to the end of the fifth segment; the third to sixth segments terminate in a slender median spine, by which this species differs from all others; third segment with a subterminal hump visible in profile. The fourth segment is provided with a lateral spine, the seventh with 3 pairs of lateral spinules.

Dimensions.—♀, length 74.5 mm., length of carapace and rostrum 29.6 mm., of carapace 12 mm.

Distribution.—From Pribilof Islands to Strait of Fuca; 45–277 fathoms (*Albatross*). Occurs usually in small numbers; most abundant in Iliuliuk Harbor.

Taken by the *Albatross* at the following stations:

Off Pribilof Islands, 56–184 fathoms, stations 3484, 3487, 3488, 3489, 3491, 3492, 3494, 3495, 3497 (type locality), 3500, 3609.

Off Makushin Bay, Unalaska, 61 fathoms, station 3318.

Off Iliuliuk Harbor, Unalaska, 277 fathoms, station 3315.

Iliuliuk Harbor, Unalaska, 45–93 fathoms, stations 3311–3314, 3334–3336.

Off Akutan Island, 51–72 fathoms, stations 2841, 2842, 3547.

Off Aektok Island, 54 fathoms, station 2844.

Unimak Pass, 50–56 fathoms, stations 3222, 3223.

South of Unimak Island, 61 fathoms, station 3216.

Shumagins, 48–58 fathoms, stations 2847, 2852.

Off Shumagin Bank, 138 fathoms, station 3339.

Off the Trinity Islands, 159 and 61 fathoms, stations 2853, 3341.

Strait of Fuca, 123 and 114 fathoms, stations 3459, 3461.

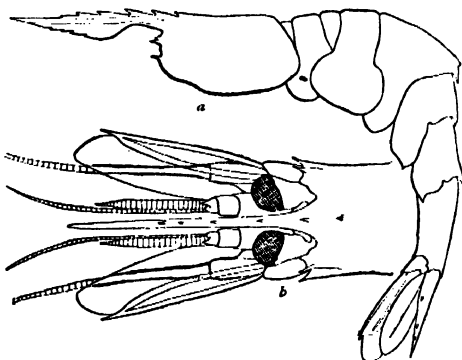


FIG. 35. *Spirontocaris barbata*. ♀. Station 3318. a. Side view of carapace and abdomen (X 1½). b. Dorsal view of anterior portion (X 2½).

SPIRONTOCARIS CARINATA (Holmes).

Heptacarpus carinatus HOLMES, Occas. Papers Calif. Acad. Sci., VII, 202, pl. III, fig. 60, 1900.

Distribution.—From Monterey Bay, shallow water (Holmes), to Point Loma, California (*Albatross*, one specimen).

The eyes of this species are very slender. The antennular peduncles extend about one third the length of acicle.

SPIRONTOCARIS STYLUS (Stimpson).

Hippolyte stylus STIMPSON, Proc. Acad. Nat. Sci. Phila., XVI, 154, 1864 (June).

Hippolyte esquimaltiana BATE, Proc. Zool. Soc. London, 1864 (read December 13), 666.

Hippolyte esquimaltians BATE, in Lord's The Naturalist in Vancouver Island and British Columbia, II, 278, 1866.

A rather slender species. Rostrum about one third longer than carapace, exceeding acicle, slender, somewhat styliform, horizontal and

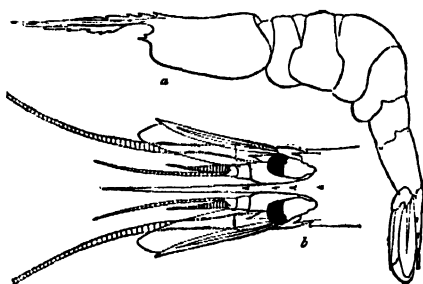


FIG. 36. *Spirontocaris stylus*. 9. Barclay Sound. a. Side of carapace and abdomen ($\times 2$). b. Dorsal view of anterior portion ($\times 3$).

straight, armed above with 4 or 5 teeth near its base (one on the carapace included) and 5 or 6 teeth below. An antennal, but no pterygostomian spine.

Eyes small. Antennular peduncle reaching about two fifths the length of the acicle; second and third segments very short; outer flagellum scarcely reaching the terminal

fourth of the acicle; inner flagellum exceeding acicle; basal scale not reaching beyond first segment. Antennal peduncle extending to end of second segment of antennular peduncle; acicle (measured along outer margin) shorter than carapace.

Maxillipeds short, slightly exceeding antennal peduncle; first pair of feet stout, not exceeding eyes; second pair reaching to middle of acicle; fifth pair scarcely to end of maxilliped.

The abdomen is strongly geniculated, though the third segment is gently rounded in profile; fourth segment unarmed; sixth segment not quite twice as long as fifth; telson with 3 pairs of side spinules.

I think there is little doubt that Bate's *H. esquimaltiana* belongs here.

Dimensions.—♀, length 44.5 mm., length of carapace and rostrum 19 mm., of rostrum 11.1 mm.

Distribution.—Barclay Sound and Sucia Island, British Columbia (*Albatross*); Esquimalt Harbor, British Columbia (Bate); Strait of Fuca (Stimpson); Port Orchard, Puget Sound (U. S. Nat. Mus.); Puget Sound (T. Kincaid).

SPIRONTOCARIS FABRICII (Kröyer).

Hippolyte Fabricii KRÖYER, Naturh. Tidsskrift, III, 571, 1841; K. Danske Vidensk. Selsk. Afhand., IX, 277, pl. 1, figs. 12-20, 1842.—SMITH, Trans. Conn. Acad. Arts Sci., v, 63, 1879.

Distribution.—Arctic coast of Alaska southward through Bering Sea to Siberia and Alaska Peninsula (Cook Inlet); Atlantic coast of America from Greenland southward to Massachusetts Bay. ? Europe (Kingsley). Depth, low water to 80 fathoms.

Taken by the *Albatross* at the following stations:

Off Cape Newenham, 17 fathoms, station 3247.
Southwest of Hagemeister Island, 17½ fathoms, station 3246.
Kululak Bay, 14 fathoms, station 3241.
Off Kululak Bay, 17 fathoms, station 3301.
Off Bristol Bay, 30-33 fathoms, stations 3302-3303.
Off Cape Menshikof, 24 fathoms, station 3296.
Off Cape Strogonof, 26-32 fathoms, stations 3291-3294.
Off Cape Seniavin, 37 and 30 fathoms, stations 3286, 3287.
Northeast of Cape Leontovich, 18 fathoms, station 3276.
Northeast of Amak Island, 19 fathoms, station 3274.
Shumagins, 21 and 35 fathoms, stations 2850, 2851.
Southwest of Sannak Islands, 38 fathoms, station 3214.
Off Rat Islands, 34 fathoms, station 3598.
Off Robben Island, Okhotsk Sea, 10-25 fathoms, stations 3645, 3649.
Unalaska, beach.

Collected by W. H. Dall:

Off Cape Sabine, 13 fathoms.
Near Indian Point, Bering Strait, 17 fathoms.
Plover Bay, Siberia, 10-25 fathoms.
Various localities in the Aleutian Islands and eastward to Chugachik Bay, Cook Inlet; low water to 80 fathoms.

Also collected:

Ten miles west of Point Franklin, Alaska, 13½ fathoms (Point Barrow Expedition).
Bering Sea, lat. 63° 50' 00" N., long. 167° 21' 00" W., 17 fathoms (Lieutenant George M. Stoney, U. S. N.).
Bering Island, two specimens in stomach of *Gadus macrocephalus*; one specimen at 12 fathoms (N. Grebnitzky).
Solovarennaja Bay, Kamchatka, 10-12 fathoms, algæ (N. Grebnitzky).
Kadiak (Harriman Expedition, W. R. Coe).

SPIRONTOCARIS GAIMARDII BELCHERI (Bell).

Plate III, figs. 3, 3a.

Hippolyte belcheri BELL, in Appendix to Belcher's Last of the Arctic Voyages in Search of Sir John Franklin, II, 402, pl. XXXIV, fig. 1, 1855.

?*Hippolyte layi* LOCKINGTON, Bull. Essex Inst., x, 161, 1878 (not *H. layi* Owen).

Hippolyte gaimardii MURDOCH, Rept. Exped. Point Barrow, p. 140, 1885 (part).

Spirontocaris gibba RATHBUN, The Fur Seals and Fur-Seal Islands of the North Pacific Ocean, pt. III, 556, 1899.

Hippolyte gibba BIRULA, Ann. Mus. Zool. Acad. Impér. Sci. St. Pétersbourg, VII, 428 [11], text fig. 1, 1899 [1900] (probably not *H. gibba* Kröyer).

Female.—Robust. Rostrum longer than the carapace, nearly horizontal posteriorly, anterior half ascending, armed above with 8 to 12 teeth (including 2 to 4 on the carapace), below with 3 to 5 teeth; rostrum tapering gradually to an acuminate tip, which exceeds the antennal scale. A strong antennal and a well-developed pterygostomian spine.

Eyes rather large, pyriform. Scale at base of antennules reaches one third the length of the second segment of the peduncle. Peduncle half as long as antennal scale; second segment twice as long as third; thickened portion of outer flagellum not reaching the tip of antennal scale, but sometimes as far as the acicular spine. This scale is shorter than the carapace; blade arcuate at extremity and exceeding the spine. The peduncle reaches about two fifths the length of the scale; the maxilliped to the distal third of the same; the first pair of feet to the end of the antennal peduncle; the second pair to a little beyond the antennal scale; the fifth pair overreaches the maxillipeds.

The fourth and fifth segments of the abdomen are each armed with a postero-lateral spine. The third segment is laterally compressed in its posterior part, which has an angular median lobe, seen in profile, a little in front of the posterior margin; on very large females this lobe becomes hook-shaped (as on one 80 mm. long). The sixth segment is about two and a half times as long as high, and shorter than the seventh, which is armed with 5 to 8 spines on each side. The outer uropods are longer than, the inner ones shorter than, the telson.

Male.—More slender than the female. Rostrum more nearly straight and horizontal, 8 or 9 teeth above. Thickened portion of outer antennular flagellum exceeding acicle. Lobe on third segment of abdomen more prominent and hooked.

Young.—In those one inch long and smaller the abdomen shows no median lobe on third segment, though it is slightly compressed. The antennular scale does not reach beyond the first segment of the peduncle.

Typical form.—In the typical *S. gaimardii* (Milne Edwards), of which *Hippolyte gibba* Kröyer is probably the male form, there is in the female no lobe on the third abdominal segment (in a side view), although the segment is somewhat compressed; the rostrum is distinctly shorter than the antennal scale, scarcely if at all longer than the carapace, and is armed with fewer spines. In both sexes the scale is longer and wider in the typical form, being about four fifths as long as the carapace.

Distribution.—*S. gaimardii belcheri* is found from the Arctic coast of Alaska and Siberia southward to Sitka, taking the place of typical *S. gaimardii*; it occurs also in Kara Sea (*Djmphna* Exped.), Nova Zembla (Birula), and at Nakvak, Labrador (L. M. Turner).

Lat. $70^{\circ} 15' 10''$ N., long. $162^{\circ} 55' 00''$ W., 16 fathoms; lat. $71^{\circ} 02' 00''$ N., long. $157^{\circ} 46' 00''$ W., 19 fathoms; and off Point Hope, Alaska, 25 fathoms (U. S. R. S. Corwin).

Ten miles west of Point Franklin, $13\frac{1}{2}$ fathoms (Point Barrow Exped.).

Bering Strait and Bering Sea in lat. $66^{\circ} 12' 00''$ N., long. $168^{\circ} 54' 00''$ W., 30 fathoms; lat. $64^{\circ} 12' 00''$ N., long. $162^{\circ} 52' 00''$ W., 17 fathoms; lat. $62^{\circ} 15' 00''$ N., long. $167^{\circ} 48' 00''$ W., $20\frac{1}{2}$ fathoms (Lieutenant George M. Stoney, U. S. N.).

Plover Bay, Siberia, 10 to 25 fathoms; Cape Lisburne; off Cape Sabine, 13 fathoms; Bering Strait, 13 fathoms; Sitka Harbor, 15 fathoms (W. H. Dall).

Off mouth of Yukon, $3\frac{1}{2}$ fathoms (E. W. Nelson).

Off St. Matthew Island, 37 fathoms, station 3519; off Pribilof Islands, 50 to 52 fathoms (*Albatross* stations 3527 and 3611).

That the *belcheri* form cannot be considered a species is shown by the existence of specimens which unite the characters with those of *S. gaimardii*. In three females from Henley Harbor, Labrador, the abdomen is without a lobe, but the rostrum is longer than the rest of the carapace, and just as long as the acicle; the acicle is long as in typical *S. gaimardii*.

SPIRONTOCARIS TOWNSENDI Rathbun.

Spirontocaris gaimardii RATHBUN, The Fur Seals and Fur-Seal Islands of the North Pacific Ocean, Pt. III, 556, 1899 (part).

Spirontocaris townsendi RATHBUN, Proc. U. S. Nat. Mus., XXIV, 897, 1902.

On the Pacific coast there is a large group of species of the *gaimardii* type, which can be distinguished only by the closest observation. Of these species, *S. townsendi* resembles *S. gaimardii* and *S. gaimardii belcheri* in having the outer maxilliped provided with an exopod and epipod, and the first two feet also with epipods. *S. townsendi* continues the range of

S. gaimardii belcheri southward. As typical *S. gaimardii* does not occur on the Pacific coast, I will compare the new form with *S. gaimardii belcheri*, and indicate the characters by which it differs from the latter.

Female.—In *S. townsendi* the rostrum reaches almost or quite to the end of the acicle, and is armed above with 5 to 7 (2 on the carapace) spines, below with 3 to 6 spines; the lower limb is deeper than in *S. gaimardii belcheri*, more as in typical *S. gaimardii*, but the rostrum is nearly straight. The pterygostomian spine is very small. The scale at the outer base of the antennula reaches to the end or nearly to the end of the second segment; the second

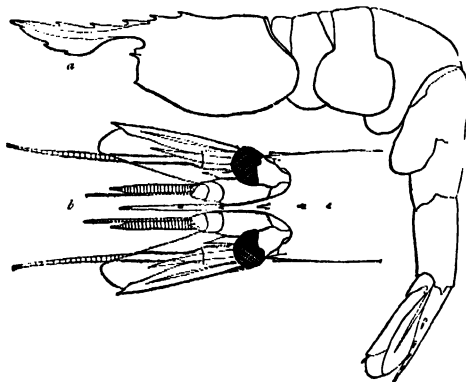


FIG. 37. *Spiontoecaris townsendi*. ♀. Station 2865. a. Side (X 24). b. Dorsal view of anterior portion (X 3).

segment is scarcely longer than the third. The antennal scale is almost as long as the carapace. The maxillipeds reach to the distal fourth of the antennal scale; the fifth pair of feet do not attain the end of the maxilliped.

The third abdominal segment is smoothly rounded, without lobe or angle, in a profile view; posterior margin produced moderately backward at the middle. The fourth segment is devoid of a lateral spine; the sixth is about twice as long as high; the telson is provided with 3 or 4 lateral spinules on each side.

Male.—The males, which are fewer in number in the collection than the females, appear to be smaller and a little more slender; otherwise, save for their longer antennulæ, they present no differences from the females.

Dimensions.—Female, approximate length 60.5 mm., of carapace and rostrum 20 mm., of rostrum 10.6 mm.

Distribution.—Ranges from the Pribilof Islands to Puget Sound, and from 21 to 114 fathoms. One exception to this bathymetrical range is 238 fathoms in Queen Charlotte Sound, British Columbia (*Albatross*

station 2862); here only one specimen was taken, of which the rostrum and tail are missing; the characters of the remaining part coincide with those of typical specimens.

Other stations at which this species was collected by the *Albatross* are:

- Off Pribilof Islands, 25-60 fathoms, stations 3484, 3496, 3558.
- Off Rat Islands, Aleutians, 55 fathoms, station 3599.
- Unalaska, 35-85 fathoms, stations 3311, 3319, 3321, 3322.
- Off North Head, Akutan Island, 56 and 72 fathoms, stations 2841, 2842.
- Off south entrance to Akutan Pass, 45 fathoms, station 2843.
- Unimak Pass, 34-56 fathoms, stations 3220, 3222, 3223.
- Northwest of Unimak Island, 43 fathoms, station 3262.
- Southwest of Sannak Islands, 41 fathoms, station 3213.
- 15 miles south of Sannak Islands, 44 fathoms, station 2846.
- Off Kudobin Islands, 36-41 fathoms, stations 3279, 3281.
- Shumagins, 48 and 21 fathoms, stations 2847, 2850.
- Off Cape Stroganof, 26 fathoms, station 3291.
- Portlock Bank, 51-68 fathoms, stations 2856, 2857.
- Admiralty Inlet, Puget Sound, 40 fathoms, station 2865.
- Washington Sound, Straits of Fuca, 48 fathoms, station 2864 (type locality).
- Strait of Fuca, 48-114 fathoms, stations 3443, 3445, 3461, 3462, 3465.
- Granite Cove, Port Althorp, Chichagof Island, Alaska (W. H. Dall).
- Puget Sound (T. Kincaid).

SPIRONTOCARIS SUCKLEYI (Stimpson).

- Hippolyte suckleyi* STIMPSON, Proc. Acad. Nat. Sci. Phila., 1864, 154; LENZ, Zool. Jahrb., Syst., XIV, 432, pl. XXXII, fig. 1, 1901.
- Spirontocaris gaimardii* RATHBUN, The Fur Seals and Fur-Seal Islands of the North Pacific Ocean, Pt. III, 556, 1899 (part).

Female.—The nearest approach in the Pacific to the *S. gaimardii* of the Atlantic. Associated with *S. townsendi*, with which it may easily be confounded; distinguished from it as follows:

The rostrum is rather more concave above instead of nearly straight; it reaches end of, or may exceed, antennal scale.

The antennular scale does not reach the end of the second segment of the peduncle.

The antennular peduncle reaches middle of antennal scale (length measured along outer margin). The second segment is appreciably longer than the third.

The antennal scale, measured on its outer margin, is much shorter than the carapace.

The outer maxillipeds overlap the distal fourth of the antennal scale, and may reach the end of the scale.

The second pereopod is commonly destitute of an epipod; sometimes

it is furnished with a rudimentary epipod, or with a fully developed one. The last pair of pereopods reach the end of the antennal scale.

The fourth abdominal segment is provided with a spine on either side

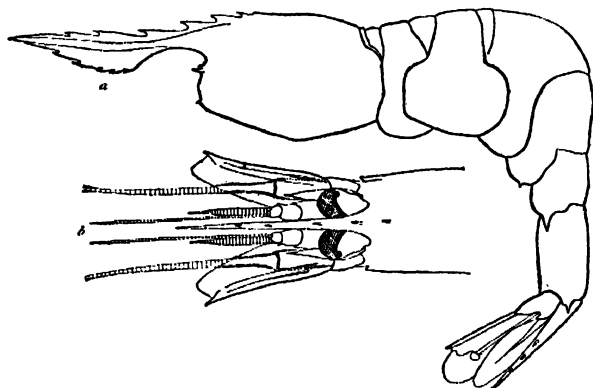


FIG. 38. *Spiontlocaris suckleyi*. ♀ (× 21). Station 3334. a. Side. b. Dorsal view of anterior portion.

below. The sixth segment is a little shorter and broader than in *S. townsendi*.

Male.—As in *S. townsendi*, the male resembles the female, except for being smaller, more slender, and with longer antennules.

S. suckleyi differs from *S. gaimardii* in the fewer dorsal spines, 5 or 6 against 7 or 8 in *S. gaimardii*; in the larger eyes; in the antennular peduncle of the female reaching middle of antennal scale; in the absence of hook or hump on the third abdominal segment in the male; in the slightly shorter sixth segment; and in the absence usually of an epipod from the second pereopod.

Variations.—In about three hundred specimens examined only one lacks the spines on the fourth abdominal segment; in another specimen the spine is present on one side, absent on the other.

Dimensions.—Length of ♀ (station 2864) approximately 79 mm., length of carapace and rostrum 28.7 mm., of rostrum 16 mm.

Distribution.—From the Arctic coast of Alaska southward to Washington; 6 to 165 fathoms.

Taken by the *Albatross* at the following stations:

Off the Pribilof Islands, 20–65 fathoms, stations 3438, 3439, 3483, 3494, 3496, 3504, 3535, 3538, 3552, 3560, 3561, 3611, 3637.
Bristol Bay, 19 fathoms, station 3237.

Off Bristol Bay, 33 fathoms, stations 3303, 3306.

North of Alaska Peninsula, 26-47 fathoms, stations 3278, 3285, 3292, 3297.

Off Unimak Island, 24-43 fathoms, stations 3259, 3262, 3265, 3266.

Off Akutan Island, 72 fathoms, station 2842.

Unalaska, 19-165 fathoms, stations 3310, 3317, 3319, 3322, 3333-3336.

Shumagins, 21-69 fathoms, stations 2847, 2849-2851.

Davidson Bank, 43 fathoms, station 3215.

Off Sitkalidak Island, 60 fathoms, station 2854.

Off Grays Harbor, Washington, 50 fathoms, station 3047.

Strait of Fuca, 48-152 fathoms, stations 2864, 3443, 3445, 3446, 3451, 3454, 3460-3462, 3596.

Cape Smyth, Alaska (Point Barrow Expedition).

Captains Harbor, Unalaska, 80 fathoms (W. H. Dall).

Bay of Islands, Adak, 9-16 fathoms (W. H. Dall).

Lituya Bay, 6-9 fathoms (W. H. Dall).

Berg Bay, Glacier Bay, and Juneau, 20 fathoms (Harriman Expedition).

Puget Sound (Stimpson); Bare Island, British Columbia (Lenz).

SPIRONTOCARIS MOSERI Rathbun.

Spirontocaris gaimardii RATHBUN, The Fur Seals and Fur-Seal Islands of the North Pacific Ocean, pt. III, 556, 1899 (part).

Spirontocaris moseri RATHBUN, Proc. U. S. Nat. Mus., XXIV, 897, 1902.

Allied to *S. gaimardii*.

Female.—The rostrum may be about as long as, or slightly exceed, the carapace; it may reach the end of the antennal scale or fall short of that point; it is gently ascending and armed with 6 to 8 teeth above (2 on carapace) and 4 to 7 below; upper limb very narrow; lower limb very broad in front of the eye, tapering rapidly to the tip, which is abruptly acute. The antennal spine is strong, the pterygostomian small but well marked.

Eyes large, pyriform. The antennular peduncle reaches to the middle or to the distal third of the antennal scale; the second segment is a little longer than the third; the thickened portion of its outer flagellum overreaches the scale; the spine of the antennular acicle reaches to the middle of the second segment or about to the end of the first segment. The antennal peduncle is very stout and nearly as long as the antennular; the scale is narrow-ovate, its outer margin about five sevenths as long as the cara-

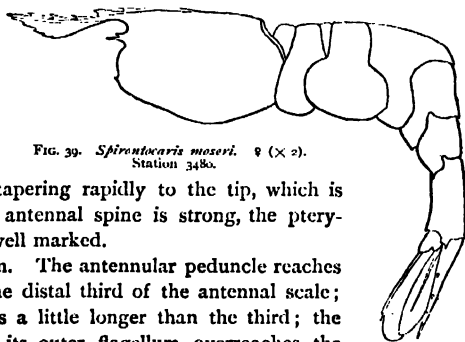


FIG. 39. *Spirontocaris moseri*. ♀ (× 2).
Station 3480.

pace; the flagellum may equal the length of the body. The maxillipeds exceed the scale by one fourth or more of the length of the last segment. The first pair of feet extended overreach the antennular peduncle; the second pair reach the tip of the maxillipeds; the fifth pair extend to or beyond the end of the antennal scale. The dactyli of the third, fourth, and fifth pairs are short and very stout, and armed with strong spines.

The third abdominal segment in profile is smoothly rounded; posteriorly it is strongly produced over the fourth; the fourth has a spine on either side; the sixth is twice as long as the fifth; the seventh is longer than the sixth and bears 4 or 5 spines on either side.

Male.—The males are smaller and their antennulæ a little longer than in the females.

Dimensions.—Female, length 57 mm., length of carapace and rostrum 22.7 mm., of rostrum 11.5 mm.

Distribution.—Bering Sea southward and eastward to Washington, 60 to 516 fathoms, at the following stations of the *Albatross*:

Off Pribilof Islands, 81 and 276 fathoms, stations 3602, 3608.

North of Rat Islands, 270 fathoms, station 3785.

Off Seguam, Aleutians, 283 fathoms, station 3480 (type locality).

North of Unalaska, 309–406 fathoms, stations 3316, 3330–3332.

Off North Head, Akutan Island, 72 fathoms, station 2842.

Off Trinity Islands, 159 fathoms, station 2853.

Off Sitkalidak Island, 60 fathoms, station 2854.

Off Queen Charlotte Sound, British Columbia, 204 fathoms, station 2861.

Off Destruction Island, Washington, 516 fathoms, station 3343.

Variations.—Specimens from the two southernmost localities show a tendency to differ from the types; the lower limb of the rostrum is narrower, the rostrum shorter and more ascending, the antennular peduncle longer and its basal scale shorter than in the types. A larger series might serve to differentiate the southern from the northern form, but at present they are combined.

SPIRONTOCARIS MAXILLIPES Rathbun.

Spirontocaris maxillipes RATHBUN, Proc. U. S. Nat. Mus., XXIV, 898, 1902.

Very near *S. moseri*, but distinguished as follows: The rostrum is shorter, only about four fifths as long as the carapace, and has usually fewer teeth, 5 to 8 above, 2 to 6 below. The antennular peduncle reaches two thirds or more of the length of the antennal scale; the second segment is a little longer than in *S. moseri*. The thickened portion of the outer flagellum overreaches the scale by about half its length. The spine of the antennular acicle scarcely reaches the middle of the second seg-

ment, or may not extend beyond the first segment. The antennal peduncle does not reach beyond the second segment of the antennular; the scale is shorter, about two thirds the length of the carapace; more than one half of the last segment of the outer maxilliped extends beyond the scale. The feet are without epipods; the first pair reach the end of the scale or extend beyond it.

The spine of the fourth abdominal somite is reduced to an almost

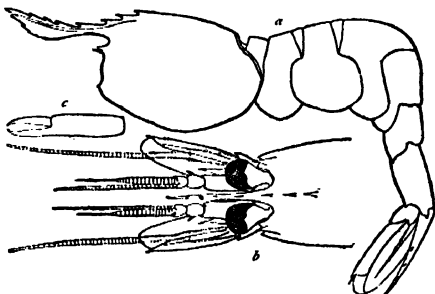


FIG. 7. *Spirontocaris axillipes*. ♀. Station 3480. a. Side (× 2). b. Dorsal portion of anter (× 2). c. Chela of first pair (× 4).

imperceptible spinule; the sixth somite is shorter than in *S. moseri*, being only one and a half times the fifth; the side spinules of the telson are commonly 3 in number, occasionally 4.

In this, as well as in the preceding species, the fingers of the first chelæ are a little over half as long as the palm.

Dimensions.—Female, length 48.9 mm., length of carapace and rostrum 18.4 mm., of rostrum 8.6 mm.

Distribution.—Aleutian Islands, 283 to 625 fathoms, at the following Albatross stations:

Off Seguam, 283 fathoms, station 3480 (type locality).

North of Unalaska, 351 and 350 fathoms, stations 3330, 3331.

Off Shumagin Bank, 625 fathoms, station 3338.

SPIRONTOCARIS BRACHYDACTYLA Rathbun.

Spirontocaris brachydactyla RATHBUN, Proc. U. S. Nat. Mus., XXIV, 898, 1902.

This species is closely allied to *S. moseri* and *S. maxillipes*, but is distinguished by the short fingers of the first chelipeds, which are not more than a third as long as the palm.

There are two specimens in the collection. The rostrum is distinctly shorter than the carapace, and, in the one specimen in which it is perfect, is armed with 6 teeth above (one on the carapace) and 3 below. No pterygostomian spine. Antennular peduncles reaching a little over half the length of the antennal scale, second segment very little longer than third; antennular scale reaching slightly beyond the first segment in the larger specimen, shorter than first segment in the smaller specimen; thick-

ened portion of outer flagellum extending nearly half its length beyond the scale. Antennal peduncle just as long as antennular. Half the last

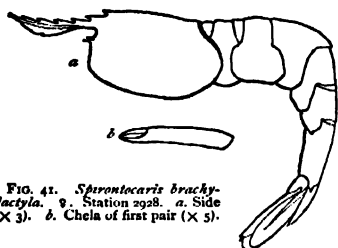


FIG. 41. *Spirontocaris brachydactyla*. ♀. Station 2928. a. Side (X 3). b. Chela of first pair (X 5).

segment of the maxilliped lies beyond the scale. The first pair of feet just reach the tip of the scale; the fingers are unusually short, as above mentioned. No spine on fourth segment of abdomen; sixth segment twice as long as fifth; telson broken.

Dimensions.—Length of ovigerous female, exclusive of rostrum and telson, 24.8 mm., length of carapace 7.7 mm.

Distribution.—Southern California, deep water. The type, an ovigerous female, was dredged off Santa Cruz Island, in 266 fathoms (*Albatross* station 2948). A much smaller female comes from off San Diego, 417 fathoms (*Albatross* station 2928).

SPIRONTOCARIS CAMTSCHATICA (Stimpson).

Hippolyte camtschatica STIMPSON, Proc. Acad. Nat. Sci. Phila., XII, p. 33, [102], 1860.

Belongs to the *gaimardii* group.

Female.—Rostrum a little longer than the carapace, shorter than antennal scale, nearly straight (or slightly concave above), horizontal, armed with 4 or 5 teeth above, the anterior tooth at about the distal third, 1 or 2 teeth on carapace; upper limb very narrow, disappearing anteriorly; lower limb deepest a little in front of the eye, and tapering distally, armed with 4 to 6 teeth; extremity acute. A strong antennal, a very small pterygostomial spine.



FIG. 42. *Spirontocaris camtschatica*. ♀. Side of carapace (X 2). Petropavlovsk.

The antennular peduncle reaches about two fifths the length of the antennal scale; second and third segments very short, the second a little the longer; the thickened portion of the outer flagellum extends to the terminal third of the antennal scale; the inner flagellum reaches to the end of the scale. The spine at the outer base of the antennules reaches to, or nearly to, the distal margin of the second segment. The outer margin of the antennal scale measures nearly as long as, just as long as, or a little longer than, the carapace; its spine falls considerably short of the laminar portion; the peduncle extends to the end of the second

segment of the antennular peduncle. The outer maxillipeds reach a little beyond the middle of the antennal scale; the first pair of feet to the end of the antennal peduncle; the second pair midway between the maxillipeds and the tip of the scale; the fifth pair to the end of the maxillipeds.

The third segment of the abdomen seen in profile is evenly rounded; it is laterally slightly compressed; fourth segment without spines; the sixth is less than twice as long as the fifth, and also shorter than the seventh, which has 4 or 5 spines on either side.

Male.—Smaller and more slender. Rostrum longer, sometimes exceeding the scale a trifle, curving upward in terminal half, armed with 5 to 7 teeth above, 5 to 9 below. The pterygostomial spine may be obsolete. The thickened portion of the outer flagellum extends to the terminal fifth of the antennal scale.

Dimensions. — ♂, approximate length 50 mm., length of carapace and rostrum 18.5 mm., of rostrum 10.2 mm. ♀, approximate length 34 mm., of carapace and rostrum 16 mm., of rostrum 9.5 mm.

Distribution.—From Arctic Alaska southward to Kamchatka and Aleutian Islands, and eastward to Port Etches.

Taken by Dr. Dall in small numbers at Cape Lisburne, 5–7 fathoms; Cape Etolin, Nunivak, 8 fathoms; Hagemeister Strait, 8–15 fathoms; Chichagof Harbor, Attu, 5–7 fathoms; Kiska Harbor, 9–12 fathoms; Constantine Harbor, Amchitka, 6–10 fathoms; Bay of Islands, Adak, 9–16 fathoms; off station reef, Iliuliuk Harbor, Unalaska, 3 fathoms; Belkofski Bay, 15–25 fathoms; Anchorage, Big Koniuji Island, Shumagins, 6–20 fathoms; Shahaska Cove, Kadiak; Chugachik Bay, Cook Inlet, 20–60 fathoms; Port Etches, 5–8 fathoms.

Bristol Bay, 14¾ fathoms (*Albatross* station 3236).

Kadiak, 5 fathoms (Harriman Expedition, W. R. Coe).

Bering Island (L. Stejneger).

Bering Island, in stomach of *Gadus macrocephalus* (N. Grebnitzky).

Rakovaya Bay, Avacha Bay, Kamchatka (L. Stejneger).

Solovarennaja Bay, Petropavlovsk, Kamchatka, 10–12 fathoms, algæ (N. Grebnitzky).

SPIRONTOCARIS KINCAIDI Rathbun.

Spirontocaris kincaidi RATHBUN, Proc. U. S. Nat. Mus., XXIV, 899, 1902.

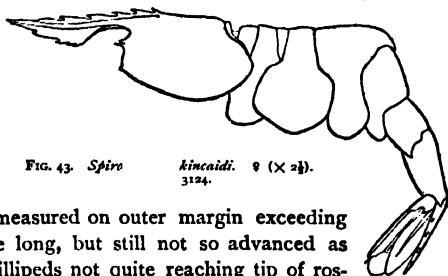
Near *S. camtschatica*.

Female.—Carapace short in relation to the abdomen. Rostrum one third longer than the carapace, not reaching tip of antennal scale, slightly concave above, horizontal, armed above with 5 (occasionally 6) teeth, two of which are on the carapace, the anterior tooth a little before the middle of the rostrum; tip acute; lower limb, as in all the *gaimardii*

group, tapering from a point in front of the eye to the tip, armed with 5 teeth, one subterminal. Antennal spine strong, pterygostomian very small.

Antennular peduncle reaching about two fifths the length of the antennal scale, second and third segments very short and subequal, outer scale reaching distal margin of second segment, outer flagellum falling short of the tip of antennal scale, inner flagellum exceeding it. Antennal peduncle almost as long as antennular; scale tapering, measured on outer margin exceeding the carapace; its spine long, but still not so advanced as the blade. Outer maxillipeds not quite reaching tip of rostrum; first pair of feet to middle of antennal scale; second pair extending just beyond maxilliped.

FIG. 43. *Spiro kincaidi*. ♀ (× 24).
3124.



The posterior margin of the third abdominal segment is produced backward in a strong lobe; the abdomen is strongly bent at this point; the fourth segment is spineless; the sixth is less than twice as long as the fifth, and a little shorter than the telson, which is armed with four pairs of lateral spines.

Dimensions.—Ovigerous ♀, length (approximate) 36.5 mm., length of carapace and rostrum 13.6 mm., of rostrum 7.7 mm.

Distribution.—From Washington to Santa Cruz, California:

Puget Sound (T. Kincaid).

Off Flattery Rocks, Washington, 40 fathoms (*Albatross* station 2873), 1 ♀.

Off Santa Cruz, California, 21 fathoms (*Albatross* station 3124), 1 ♀ (type).

Strait of Fuca, 37 fathoms (*Albatross* station 3593), 1 egg-bearing ♀, placed here with doubt. The rostrum and telson are broken, the antennulæ are a little longer than in the type, their peduncles reach nearly to the middle of the acicle.

SPIRONTOCARIS LAYI (Owen).

Hippolite Layi OWEN, in Zoology of Captain Beechey's Voyage [in the *Blossom*], Crustacea, p. 90, pl. XXVII, fig. 3, 1839.

Distribution.—Monterey, California (Owen); Esquimalt Harbor, Vancouver Island (Bate).

Owen's description is as follows:

"Hip. rostro acuminato, supra multi-serrato, ante medium subtus quadri-serrato. Long. corp. unc. $2\frac{1}{2}$. Color ruber." According to

Owen, the rostrum is longer and narrower than in *S. affinis*, extending to the extremity of the superior antennæ; the dental formula was the same, $\frac{1}{4}^0$, in the 3 specimens preserved. According to Owen's figure, the antennular peduncle extends about to the middle of the rostrum, the second and third segments are subequal, the thickened portion of the outer flagellum is shorter than the peduncle. The rostrum curves strongly upward in its anterior half.

SPIRONTOCARIS BIUNGUIS Rathbun.

Spirontocaris biunguis RATHBUN, Proc. U. S. Nat. Mus., XXIV, 899, 1902.

This species of the *gaimardii* group is an inhabitant of deeper water, and is distinguished by its larger eyes, longer rostrum, subchelate dactyli, and by having an exopod and an epipod on the outer maxilliped, while the pereopods are destitute of epipods.

Carapace carinated on its anterior half or two thirds. Rostrum from one and a fourth to one and two thirds times as long as remainder of carapace, its poste-

rior half or third gradually ascending, the remainder more abruptly so; upper limb narrow, the widest point in front of the eye; lower limb a little wider than

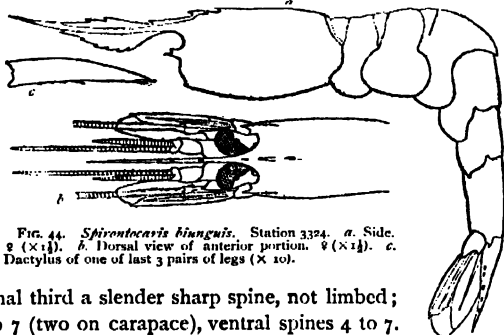


FIG. 44. *Spirontocaris biunguis*. Station 3324. a. Side. ♀ (×14). b. Dorsal view of anterior portion. ♀ (×14). c. Dactylus of one of last 3 pairs of legs (×10).

the upper; terminal third a slender sharp spine, not limbed; dorsal spines 5 to 7 (two on carapace), ventral spines 4 to 7. Antennal spine strong; pterygostomian spine or tooth very small.

Eyes very large and oblique, pyriform, the cornea covering the greater part of the peduncle. Antennular peduncle extending a little past the middle of the antennal scale; second joint three times as long as third; outer scale reaching to end of first segment; thickened portion of outer flagellum extending in the female one third, in the male two thirds of its length beyond antennal scale. This last is four fifths as long as carapace; antennal peduncle reaching end of second segment of antennular peduncle; flagellum longer than the body.

The tips of the maxillipeds are half way between the antennal peduncle and the tip of the scale. The first pair of feet attain the middle of the last joint of the antennal peduncle; the palm is less than twice as long as

the fingers. The second pair exceed the acicle. The last 3 pairs are very slender and about the same length, the tip of the last pair reaching the terminal third of the rostrum; the extremity of the propodi is fringed with bristles; the dactyli are slender; the proximal half of their concave margin is furnished with 5 or 6 spinules so closely appressed that to the naked eye the dactylus appears unarmed; the distal spinule is long, and with the slender tip of the dactylus gives the appearance of a minute chela.

The abdomen is non-carinated; the fourth segment is unarmed; the sixth segment is one and a half times the fifth; the seventh is a little longer than the sixth and armed with 5 or 6 spinules on each side.

Dimensions.—Length of egg-laden ♀ 83 mm., length of carapace and rostrum 37.6 mm., of rostrum 23.2 mm.

Distribution.—From Bering Sea (off Pribilof Islands) to Oregon, 109–987 fathoms.

Dredged by the *Albatross*:

Off Pribilof Islands, 184–688 fathoms, stations 3489, 3501, 3502, 3608. North of Aleutian Islands (178° 31' 00" E.), 850 fathoms, station 3784. North of Rat Islands, 270 fathoms, station 3785.

North of Unalaska, 225–987 fathoms, stations 3227, 3316, 3329–3332, 3607.

West of Unalaska, 576 fathoms, station 3326.

Chernofski Harbor, Unalaska, 109–284 fathoms, stations 3324, 3325.

Off Shumagin Bank, 625 fathoms, station 3338.

Southeast of Chirikof Island, Alaska, 695 fathoms, station 3340.

Off Cape St. James, Queen Charlotte Islands, British Columbia, 876 fathoms, station 2860 (type locality).

Off Sea Lion Rock, Washington, 636–877 fathoms, stations 3069–3071, 3074, 3075.

Off Cape Elizabeth, Washington, 831 fathoms, station 3344.

Off Grays Harbor, Washington, 559 fathoms, station 2871.

Off Tillamook Bay, Oregon, 786 fathoms, station 3346.

SPIRONTOCARIS PALPATOR (Owen).

Hippolyte palpator OWEN, in Zoology of Captain Beechey's Voyage [in the *Blossom*], Crustacea, p. 89, pl. XXVIII, fig. 3, 1839.

Heptacarpus palpator HOLMES, Occas. Papers Calif. Acad. Sci., VII, 196, pl. III, figs. 48, 49, 1900, and synonymy.

Distribution.—San Francisco Bay, California (Stimpson), to Magdalena Bay, Lower California (Lockington). Monterey (Owen). The specimen from Kadiak referred by Brandt to this species is probably *S. brevirostris*, as stated by Dr. Holmes.

Specimens in the National Museum are from Pacific Grove, California (John C. Brown); San Diego (H. Hemphill, C. R. Orcutt); San Diego

County (C. R. Orcutt); San Diego Bay, 5-6 $\frac{3}{4}$ fathoms (*Albatross* stations 3575-3578, 3582).

SPIRONTOCARIS BREVIROSTRIS (Dana).

Hippolyte brevirostris DANA, Proc. Acad. Nat. Sci. Phila., 1852, 24; Crust. U. S. Expl. Exped., I, 566, 1852, pl. XXXVI, fig. 5, 1855.—STIMPSON, Jour. Boston Soc. Nat. Hist., VI, 500, 1857.

Spirontocaris brevirostris WALKER, Trans. Liverpool Biol. Soc., XII, 276, 1898.

Heptacarpus brevirostris HOLMES, Occas. Papers Calif. Acad. Sci., VII, 198, pl. III, figs. 50, 51, 1900, and synonymy.

Distribution.—Attu, Aleutian Islands, to San Francisco Bay, California. Nine localities between Attu and Sitka, low water to 25 fathoms (W. H. Dall).

Unalaska (S. Applegate).

Aleutian Islands (L. M. Turner).

Kadiak (W. J. Fisher).

Tongass, Alaska (H. E. Nichols).

Yakutat; Kadiak, 5 fathoms; Sitka (Harriman Expedition).

Otter Bay, Pender Island, Seymore Narrows, British Columbia; Sucia Island, British Columbia; Port Angeles, Washington (*Albatross*).

Fort Rupert, British Columbia (Harlan I. Smith).

Strait of Fuca.

Puget Sound (T. Kincaid).

Cape Mendocino, California (University of California).

San Francisco Bay (H. Hemphill).

Previously recorded from Kadiak (Brandt, as *palpator*); Vancouver Island (Smith); Strait of Fuca, near Dungeness (Dana); Humboldt County, California (Holmes); San Francisco Bay (Stimpson, Holmes).

SPIRONTOCARIS PUSIOLA (Kröyer).

Hippolyte pusiola KRÖYER, Naturh. Tidssk., III, 576, 1841; K. Danske Vidensk. Selsk. Afhand., IX, 319, pl. III, figs. 69-73, 1842.—SMITH, Trans. Conn. Acad. Arts Sci., V, 77, pl. IX, figs. 4-7 (telson), 1879.

Distribution.—Bering Island, Aleutian Islands, and Alaska Peninsula eastward to Chichagof Island, 5-159 fathoms. Gulf of St. Lawrence to Long Island Sound, low water to 105 fathoms. Greenland? Iceland. Northern Europe.

Collected by the *Albatross*:

Off North Head, Akutan Island, 56-72 fathoms, stations 2841, 2842.

Davidson Bank, 42 fathoms, station 2845.

Northeast of Amak Island, 19 fathoms, station 3274.

North of Bird Island, Shumagins, 21 fathoms, station 2850.

Off Trinity Islands, 159 fathoms, station 2853.

By W. H. Dall at:

Port Levashof, Unalaska, 20-30 fathoms.

Iliuliuk Harbor, Unalaska, 10 fathoms.

Captains Harbor, Unalaska, outside of ridge, 25-75 fathoms.

Off Round Island, Coal Harbor, Unga, 8-9 fathoms.

Anchorage, Big Koniuji Island, Shumagins, 6-20 fathoms.

Popof Strait, near reef, 6 fathoms.

Shahafka Cove, Kadiak, 12-14 fathoms.

Chugachik Bay, Cook Inlet, 20-60 fathoms.

Port Etches, 5-8 fathoms.

Granite Cove, Port Althorp, Chichagof Island.

Bering Island (L. Stejneger).

Bering Island, among Laminaria (N. Grebnitzky).

The males grow to be as large and robust as the females; they have the antennular peduncle and outer maxilliped much longer than in the female; in old males the peduncle is about four fifths as long as the antennal scale, first segment extending half its length beyond the eyes, outer basal scale only two thirds as long as first segment, second segment twice as long as third. Antennal scale, measured on outer margin, two thirds as long as carapace; peduncle overreaching slightly the first segment of the antennular peduncle. The penult segment of the outer maxilliped slightly overreaches the antennal peduncle; the terminal segment is very long, as long as the carapace.

Dimensions.—A male measures 25 mm. long, carapace and rostrum 8.3 mm., rostrum 2.5 mm.

SPIRONTOCARIS HERDMANI Walker.

Spirontocaris herdmani WALKER, Trans. Liverpool Biol. Soc., XII, 277, pl. XVI, fig. 2, 1898.

Small. Carapace high. Rostrum two thirds length of carapace proper, reaching nearly or quite to end of, or a little beyond, first antennular segment, straight, deflexed; upper margin armed with 3 to 6 teeth, one of which is on the carapace, anterior tooth remote from the tip, which is pointed; lower margin with one or two teeth near the tip. Antennal and small pterygostomial spine present. Antennular peduncle reaching a little past middle of antennal scale; second and third joints very short, the second a little the longer; basal scale reaching to end of first segment; thickened part of outer flagellum extending beyond acicle. Acicle nearly as long as carapace; antennal peduncle nearly as long as antennular. Outer maxilliped extending beyond scale by half length of last segment. First pair of feet exceeding scale a little. Fourth segment of abdomen provided with a small lateral spine; sixth segment short, very little longer than wide; telson with three spinules on each side.

Walker says of this species that "the rostrum reaches a little beyond the end of the peduncle of the inner antennæ," but this may be an error, as in the figure the rostrum is represented not much longer than the eye.

Dimensions.—Length of female with ova 30 mm. (Walker). Length of female with ova 16.2 mm., length of carapace and rostrum 5.2 mm., of rostrum 2.1 mm.

Distribution.—Sitka, Alaska, 10 fathoms, June 15, one ♀ with ova (Harriman Expedition). Puget Sound, 1895, 3 specimens (T. Kincaid). Puget Sound (Walker).

SPIRONTOCARIS TAYLORI (Stimpson).

Hippolyte taylori STIMPSON, Jour. Boston Soc. Nat. Hist., VI, 500, 1857.

Heptacarpus Taylori HOLMES, Occas. Papers Calif. Acad. Sci., VII, 199, pl. III, figs. 52, 53, 1900, and synonymy.

Distribution.—San Francisco Bay, California, to Magdalena Bay, Lower California. Specimens in the National Museum from Monterey (D. S. Jordan, 1880, and J. O. Snyder, 1895), San Pedro (*Albatross*), Point Loma (*Albatross*), San Diego (Rosa Smith).

One of the three females collected by Dr. Jordan has an abnormal rostrum, longer and more slender than in typical specimens, still not reaching the cornea; in other respects the individual agrees with its associates.

SPIRONTOCARIS PICTA (Stimpson).

Hippolyte picta STIMPSON, Ann. Lyc. Nat. Hist. N. Y., X, 125, 1871.

Heptacarpus pictus HOLMES, Occas. Papers Calif. Acad. Sci., VII, 200, pl. III, figs. 54 and 55, 1900, and synonymy.

Distribution.—Monterey Bay to San Diego, California. Specimens are in the National Museum from Monterey Bay (*Albatross*), Pacific Grove (H. Heath, John C. Brown), Catalina Harbor (W. H. Dall), Lajolla (*Albatross*), San Diego (various collectors).

SPIRONTOCARIS PALUDICOLA (Holmes).

Heptacarpus paludicola HOLMES, Occas. Papers Calif. Acad. Sci., VII, 201, pl. III, figs. 56, 57, 1900.

Distribution.—Humboldt Bay (Holmes) to San Diego, California. Specimens are in the National Museum from San Diego (*Albatross*), and from either Monterey or Catalina Harbor (Dall).

Since this paper went to press, a *Spirontocaris* from Pearson, Washington, has been received, through R. W. Doane, which seems to be undescribed. It has the coloration of *S. picta*, a rostrum similar to that of *S. paludicola*, while the epipods are as in *S. sitchensis*.

SPIRONTOCARIS SITCHENSIS (Brandt).

Hippolyte sitchensis BRANDT, Middendorff's Reise Sibir., II, Zool., Theil I, 116, pl. v, fig. 18, 1851.—?? STIMPSON, Jour. Boston Soc. Nat. Hist., VI, 499, 1857 (Monterey).

?? *Hippolyte sitchensis* STIMPSON, Ann. Lyc. Nat. Hist. N. Y., x, 125, 1871.

This species resembles most *S. paludicola* of California. It differs, however, in its shorter rostrum, which is two thirds or four fifths the length of the carapace; in the shorter antennular scale, only slightly exceeding the first segment of the peduncle; in the shape of the antennal scale, which is broadly arcuate at the end, the blade exceeding the spine; in lacking an epipod on the second pereopod.

Distribution.—From Sitka, Alaska, southward to Puget Sound:

Sitka (Brandt); Cape Fox, 3 ♀ (W. R. Coe, Harriman Expedition); Tongass, July 16, 1885, 3 ♀ (Lieutenant H. E. Nichols, U. S. N.); Refuge Cove, Port Chatham, 1 ♀ (W. H. Dall); Puget Sound (Calman).

SPIRONTOCARIS CRISTATA (Stimpson).

Hippolyte cristata STIMPSON, Proc. Acad. Nat. Sci. Phila., 1860, 33 (not *H. cristatus* De Haan, 1849).¹

Spirontocaris cristata WALKER, Trans. Liverpool Biol. Soc., XII, 277, 1898. *Heptacarpus cristatus* HOLMES, Occas. Papers Calif. Acad. Sci., VII, 202, pl. III, figs. 58, 59, 1900.

Distribution.—From Sitka, Alaska, to San Diego, California:

Sitka, 10 fathoms (Harriman Expedition); Puget Sound (Walker, also collected by T. Kincaid).

San Pablo Bay, taken in Chinese shrimp-nets (*Albatross*).

Monterey Bay, 33 fathoms (*Albatross* station 3132); Monterey (J. O. Snyder).

San Diego Bay 3-6¾ fathoms (*Albatross* stations 3563, 3567, 3575-3578).

San Diego, 10 fathoms (H. Hemphill); south of San Diego Bay, 22 fathoms (*Albatross* station 3679).

Southern California (W. H. Dall).



FIG. 45. *Spirontocaris cristata* (× 103). Station 3567. Chela of first pair. a. ♂. b. ♀.

I have a little doubt about the single specimen from Sitka, as it is much mutilated; it is not, however, referable to any other species.

The male differs peculiarly from the female. It has the customary points of difference: It is smaller, more slender, the rostrum is more slender and slightly overlaps the second antennular

¹ I have considered that De Haan's use of this name on plate XLV did not invalidate it for Stimpson's species, because De Haan in his Errata (p. 244), as well as in the explanatory text (p. 194), corrected the name of his species to *Sicyonia cristata*, the correction appearing, so far as I am able to ascertain, simultaneously with the plate.

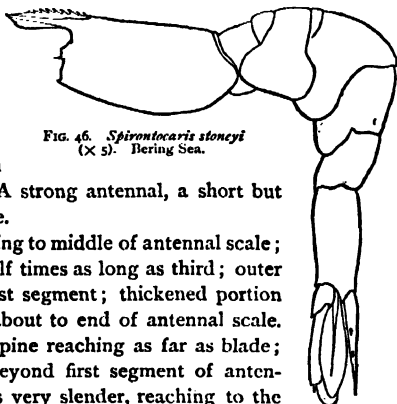
segment instead of reaching to the end of it; but the most striking character is the unusual length of the fingers, which exceed the palm in length and are rather slender, giving the chelæ a *Pulemon*-like appearance; in the ♀, on the contrary, the fingers are considerably shorter than the palm, as in most species of the genus.

SPIRONTOCARIS STONEYI Rathbun.

Spirontocaris stoneyi RATHBUN, Proc. U. S. Nat. Mus., XXIV, 899, 1902.

Near *S. cristata*; a small, slender species. Rostrum about half as long as the carapace and reaching a little beyond first segment of antennular peduncle; upper margin convex and armed with 7 to 9 teeth (1 or 2 of which are on carapace), except near the tip, where it is straight and unarmed; tip pointed; midrib nearly straight, lower margin with a tooth near the tip. A strong antennal, a short but slender pterygostomian, spine.

FIG. 46. *Spirontocaris stoneyi*
(X 5). Bering Sea.



Antennular peduncle reaching to middle of antennal scale; second segment one and a half times as long as third; outer scale not reaching end of first segment; thickened portion of outer flagellum reaching about to end of antennal scale. Scale as long as carapace; spine reaching as far as blade; peduncle reaching a little beyond first segment of antennular peduncle. Maxillipeds very slender, reaching to the distal third of the antennal scale; the first pair of feet to a little beyond the antennal peduncle, the palm widening distally and only a little longer than the fingers; second pair of feet about reaching tip of scale.

Fourth abdominal somite unarmed; sixth long, over $1\frac{1}{2}$ times as long as fifth, and as long as telson, which has 3 pairs of side spines.

Dimensions.—Female, length 20 mm., length of carapace and rostrum 5.5 mm., of rostrum 1.8 mm.

Type locality.—Bering Sea, lat. $62^{\circ} 15' 00''$ N., long. $167^{\circ} 48' 00''$ W., $20\frac{1}{2}$ fathoms (Lieutenant George M. Stoney, U. S. N., June, 1884).

SPIRONTOCARIS AVINA Rathbun.

Spirontocaris avina RATHBUN, The Fur Seals and Fur-Seal Islands of the North Pacific Ocean, III, 557, 1899.

Carapace with anterior half carinated; rostrum half or less than half the length of the carapace, reaching to end of first antennular segment;

strongly arched over the eye, and armed with 12 to 14 small teeth; the posterior 3 or 4 behind the orbit, the posterior 2 distinctly separated from the others; the hindermost is much depressed, obsolescent; the distal

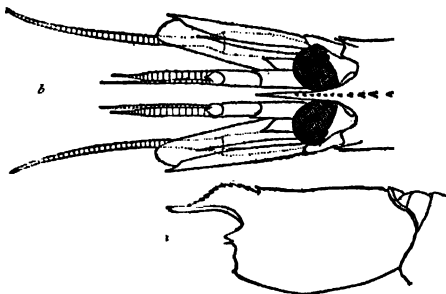


FIG. 47. *Spirontocaris avina*. Station 2853. a. Side of carapace (X 3). b. Dorsal view of anterior portion (X 4).

third of the rostrum is straight, either horizontal or slightly deflexed, acute, unarmed above, furnished with 1 or 2 teeth below; lower limb very narrow. Antennal spine well developed, pterygostomian very small.

Eyes large, pyriform. Antennular peduncle extending two thirds

the length of the antennal scale, second segment three times as long as third, outer basal scale suberect and not reaching end of first segment; flagella subequal in length; thickened part of outer one extending half its length beyond antennal scale. Outer margin of antennal scale a little more than two thirds as long as carapace, scale tapering, distal margin very oblique, peduncle extending quite to middle of scale and nearly to end of second segment of antennular peduncle.

The outer maxillipeds extend beyond the scale by nearly half the length of their last segment. First pair of feet reaching half-way between antennal peduncle and end of scale; second pair exceeding maxilliped by the length of the propodus and the last joint of the carpus; third to fifth pairs nearly equal, the fifth pair overreaching the second pair; dactyli very slender and unarmed.

Abdomen smooth; fourth segment furnished with a lateral spine; sixth segment a little less than twice as long as fifth, and shorter than seventh, which bears 3 spinules on each side.

Male.—Smaller, more slender, and has slightly longer antennulæ than the female.

Dimensions.—Female, length 35 mm., length of carapace and rostrum 12 mm., of rostrum 3.5 mm.

Distribution.—From Pribilof Islands to Oregon, 41 to 351 fathoms. Taken exclusively by the *Albatross*, at the following localities: Off Pribilof Islands, 60–184 fathoms, stations 3484, 3485, 3489, 3494, 3605, 3609. North of Unalaska, 165–351 fathoms, stations 3315, 3317, 3330 (type locality), 3331.

Iliuliuk Harbor, Unalaska, 58-68 fathoms, stations 3310, 3313.
 Off Akutan Island, 72-91 fathoms, stations 2842, 3548.
 Northwest of Unimak Island, 81-85 fathoms, stations 3225, 3257.
 Off Kudobin Islands, 41 fathoms, station 3279.
 Between Unga and Nagai Islands, Shumagins, 110 fathoms, station 2848.
 Off the Trinity Islands, 159 fathoms, station 2853.
 Gulf of Georgia, British Columbia, 67 fathoms, station 2863.
 Strait of Fuca, 53-100 fathoms, stations 3443, 3445, 3446, 3460, 3596, 3597.
 Near Flattery Rocks, Washington, 171 fathoms, station 2866.
 Off Heceta Bank, Oregon, 277 fathoms, station 2890.

SPIRONTOCARIS MACILENTA (Kröyer).

Hippolyte macilenta KRÖYER, Naturh. Tidssk., III, 574, 1841; K. Danske Vidensk. Selsk., Afh., IX, 305, pl. II, figs. 55, 56, 1842.—SMITH, Trans. Conn. Acad. Arts Sci., V, 71, 1879.

Spirontocaris macilenta RATHBUN, The Fur Seals and Fur-Seal Islands of the North Pacific Ocean, Pt. III, 557, 1899.

Distribution.—Arctic and Atlantic coasts of North America, as far south as Halifax, Nova Scotia; Bering Sea; Kamchatka; Okhotsk Sea; 16 to 100 fathoms.

The following localities on the Alaskan and Asiatic coasts are represented in the Museum collection:

Arctic Ocean (U. S. R. S. *Corwin*).

Bering Strait (Dr. Robert White).

Lat. $66^{\circ} 30' 25''$ to $66^{\circ} 43' 00''$ N., long. $167^{\circ} 14' 10''$ to $168^{\circ} 08' 15''$ W., 19-30 fathoms (U. S. R. S. *Corwin*).

Bering Sea, between Matthew Island, Pribilof Islands, and Bristol Bay; $29\frac{1}{2}$ -39 fathoms (*Albatross* stations 3252, 3306, 3507, 3511, 3513, 3518, 3519).

Off Kamchatka, 39-42 fathoms (*Albatross* station 3781).

Avacha Bay, Kamchatka, 16 fathoms (*Albatross* station 3642).

Southeast coast of Kamchatka, 100 and 96 fathoms (*Albatross* stations 3643, 3644).

Off Robben Island, Okhotsk Sea, 25 fathoms (*Albatross* station 3649).

SPIRONTOCARIS MACROPH'THALMA Rathbun.

Spirontocaris macrophthalma RATHBUN, Proc. U. S. Nat. Mus., XXIV, 900, 1902.

Allied to *S. macilenta* and *S. bispinosa*.

Female.—Carapace carinated in its anterior half, posterior spine at the anterior fifth; upper line of carapace and midrib of rostrum nearly horizontal, the rostrum gently ascending in its anterior portion; rostrum about three fourths or five sixths as long as the carapace, upper and lower limbs with convex margins, and widest at about the middle of their

length; upper margin armed with 10 to 14 teeth, including 2 or 3 on the carapace; lower margin with 1 to 3 spines; tip acute. A strong antennal

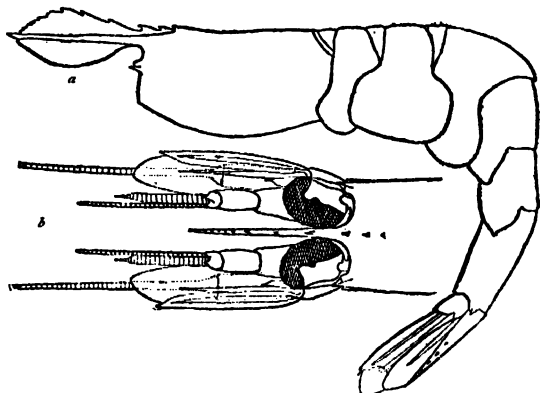


FIG. 48. *Spirontocaris ma rophthalma*. Station 3076. a. Side view of anterior portion, ♀ ($\times 24$).
b. Dorsal view of anterior portion, ♀ ($\times 24$).

spine on the anterior margin, no supraorbital nor pterygostomian spine; antero-lateral angle sharp.

Eyes large, pyriform; corneæ extending on the inner side almost to the base of the peduncle. Eyes reaching two thirds the length of the first antennular segment; this segment is twice as long as the second, and the second three times as long as the third; the second and third are each provided with a terminal spine; the peduncle does not reach the end of the rostrum; the thickened part of the outer flagellum exceeds by half its length the antennal scale; inner flagellum half again as long as outer; the basal scale does not quite reach the end of the first segment; it has a strong lobe on its proximal outer margin. The peduncle of the antennæ extends to the end of the second segment of the antennulæ and the middle of the scale; the flagellum is one and a third times the length of the body. The blade of the scale exceeds the spine considerably, and is most advanced toward its inner margin.

The outer maxillipeds are slender and reach midway between the end of the antennal peduncle and the end of the scale. The first pair of feet reach just beyond the base of the scale; the second pair just beyond the end of the scale; of the carpal joints, the second is greater than the first, the first plus the second equals the third, the fourth equals the seventh, the fifth is greater than the sixth, the fifth plus the sixth exceeds a little the seventh. The last three pairs of feet are long, fragile, and unarmed;

the last pair may extend beyond the antennal scale by the length of the dactylus and two thirds of the propodus.

The first four segments of the abdomen are unarmed; the third produced moderately backward in the middle; fifth with a spine at the infero-posterior angles; sixth with a spine at the infero-posterior and supero-posterior angles; sixth nearly twice as long as fifth; telson about as long as sixth segment, with 5 or 6 pairs of lateral spinules; extremity with a pair of long median spines, a longer pair of submedian spines, and a pair of short outer spines.

Male.—The males exhibit the usual differences from the females in being more slender, in the longer antennular flagella, and in the abdominal appendages.

Dimensions.—Female, length 62.6 mm., length of carapace and rostrum 24 mm., of rostrum 11 mm.

Distribution.—From the north coast of Unalaska eastward and southward to Point Sur, California, 178 to 636 fathoms. Taken by the *Albatross* at the following stations:

North of Unalaska, 399 and 350 fathoms, stations 3329, 3331.

Off Davidson Bank, 280 fathoms, station 3337.

South of Sannak Islands, 483 fathoms, station 3210.

Clarence Strait, 322 fathoms, station 3077.

Off Queen Charlotte Sound, British Columbia, 204 fathoms, station 2861.

Off Tahwhit Head, Washington, 178 fathoms, station 3076 (type locality).

Off Destruction Island, Washington, 516 fathoms, station 3343.

Off Sea Lion Rock, Washington, 636 and 477 fathoms, stations 3070, 3073.

Off Cascade Head, Oregon, 345 fathoms, station 3347.

Off Heceta Bank, Oregon, 277 fathoms, station 2890.

Off Point Arena, California, 455 and 239 fathoms, stations 3348, 3349.

South of Farallone Islands, California, 391 and 217 fathoms, stations 3104, 3105.

Off Pigeon Point, 296 fathoms, station 3112.

Off Monterey Bay, 418–581 fathoms, stations 3126, 3127, 3670.

Monterey Bay, 278 fathoms, station 3669.

Off Point Sur, 298 fathoms, station 3187.

Affinities.—Resembles the preceding species, *S. macilentus*, but differs notably in the much larger and more reniform eyes, the longer rostrum, of which the upper limb is narrowed at its base and the lower limb is less deep, in the larger dorsal spines and the shorter scale. From *S. bispinosa* at once distinguished by the absence of a supraorbital spine, of the long, slender process of the rostrum and of the spine at the middle of the carapace. The sixth segment of the abdomen is longer and more slender than in *S. bispinosa*.

Family *ALPHEIDÆ*.Genus *Alpheus* Fabricius.*ALPHEUS DENTIPES* Guérin.

Alpheus dentipes GUÉRIN, Exp. Scient. Morée, part. Zool., 39, pl. XXVII, fig. 3, 1832.

Alpheus clamator HOLMES, Occas. Papers Calif. Acad. Sci., VII, 182, 1900, and synonymy.

Distribution.—Farallone Islands, California, to San Bartolomé Bay, Lower California. Mediterranean; Cape Verde Islands; Bermudas; Porto Rico; Cuba; Key West.

ALPHEUS BELLIMANUS Lockington.

Distribution.—From Monterey to San Diego, California. Chile (Coutière).

ALPHEUS BARBARA Lockington.

Habitat.—Santa Barbara, California.

According to Coutière, probably the same as *A. macrocheles* (Hailstone).

ALPHEUS CALIFORNIENSIS Holmes.

Habitat.—San Pedro, California.

ALPHEUS EQUIDACTYLUS Lockington.

Distribution.—Monterey to Santa Barbara, California.

According to Coutière, this is *Alpheopsis trispinosus* (Stimpson).

Genus *Betæus* Dana.*BETÆUS HARFORDI* Kingsley.

Distribution.—Point Arena to Catalina Island, California.

BETÆUS LONGIDACTYLUS Lockington.

Distribution.—San Pedro to San Diego, California.

BETÆUS HARRIMANI sp. nov.

Female, with eggs.—Carapace compressed, upper line nearly horizontal; frontal margin nearly straight, with a broad, shallow, almost imperceptible median sinus, and a deeper sinus just outside the eye. Basal scale of the antennules broad at base (the breadth of each equaling the interspace), narrowing distally, and somewhat scythe-shaped, curving slightly inward toward the extremity, which reaches the distal third of

the second joint; second joint about one and a half times as long as the third; inner flagellum about one fourth longer than the carapace; outer flagellum about two thirds the length of the inner and becoming much smaller at the middle, the distal half very slender.

Antennæ with a strong spine below the base of the acicle; peduncle slightly exceeding that of the antenna; scale with a broad terminal spine, which reaches the end of the antennular peduncle, and exceeds the blade, from which it is separated by a short narrow slit; flagellum nearly twice the length of the carapace. Maxillipeds reaching a little past the middle of the terminal segment of the antennal peduncle.

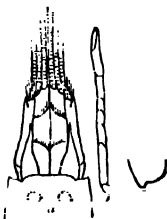


FIG. 49. *Petrus harrimanii*. a. Dorsal view of anterior portion ($\times 4$). b. Carpus and chela of second pair ($\times 5\frac{1}{2}$). c. Left chela of first pair ($\times 2\frac{1}{2}$).

Chelipeds subequal, similar, of very moderate size; merus with rounded angles, the distal end widened, length about two and a half times breadth, outer surface with a broad oblique sulcus, a transverse groove at the supero-distal angle, behind which the upper margin ends abruptly, but does not terminate in a spine; surface granulate, lower surface granulo-spinulose. Carpus small, rounded. Hand narrow-oblong, somewhat compressed, finely scabrous, margins rounded, the length not more than one half greater than that of the preceding joints combined. Fingers fitting close together, the pollex narrowly conical and twice as wide at base as the dactylus, which is subcylindrical; the tips are sharp and cross each other; the prehensile edges are subentire, very finely denticulate, that of the pollex convex except at the tip.

The first joint of the carpus of the second pair of feet is about as long as the three following combined; the third and fourth are equal, the second a little longer than either; the fifth twice as long as the fourth, and slightly shorter than the palm, which is subequal to the fingers.

The propodi of the remaining feet have a row of six or seven spines beneath; the dactyli are over a third the length of the propodi and very acuminate.

The postero-lateral angles of the fourth and fifth abdominal segments are rounded, of the sixth blunt. The distal end of the peduncle of the uropods bears a pair of spines; a spine near the outer angle of the uropods.

Color.—Light green.

Dimensions.—Female, length of body to tip of telson 26.6 mm.; length of carapace 10 mm.; length of cheliped 17.5 mm.; length of palm 6 mm.; of dactyl 4.6 mm.

Type locality.—Sitka (W. R. Coe, Harriman Expedition); one female

with ova (U. S. National Museum, No. 25,692). This species represents a more northern latitude than any Alpheid hitherto described.

Affinities.—The species differs from *B. longidactylus* Lockington in its small hands, non-gaping fingers devoid of teeth, in the relative lengths of the carpal segments of the second pair of legs, in the shorter antennular spine, in the unequal peduncular joints of the antennulæ, as well as in some minor respects.¹

Family *LYSMATIDÆ*.

Genus *Processa* Leach.

PROCESSA CANALICULATA Leach.

Processa canaliculata LEACH, Mal. Podoph. Brit., pl. XLI, and corresponding text, July 1, 1815.—RATHBUN, Bull. U. S. Fish Comm. for 1900, vol. II, p. 104, 1901, and synonymy.

Two specimens of unusual interest were taken at San Diego, California, by D. S. Jordan, in 1880. They are about 22 mm. long, and differ from typical specimens in having the left foot of the first pair similar to the right, or chelate. One specimen is a female, and has both chelipeds present. The other is so mutilated that the sex is indeterminable; it has a left cheliped, the right is missing. This form might perhaps be deemed a distinct species or genus were it not that among a lot of specimens from Cedar Keys, Florida, both forms occur. From this locality they are small (12 to 15 mm. long), and five specimens are bichelate, while four have only a right cheliped, the left foot being simple, as in typical *P. canaliculata*. These two forms from the same locality present no other appreciable difference.

Aside from this remarkable dimorphism in the left first foot, the species is a most variable one. The rostrum may be half as long or nearly as long as the eye. The eyes, while always of good size, are not uniform, in some cases larger and more reniform, with the cornea extending on the outer side almost back to the carapace. The second joint of the antennulæ varies from one and a fourth to twice the length of the third joint. The antennal scale may be a little more than half as long as the carapace (rostrum excluded) or even two thirds as long as carapace; it may be just as long as the antennular peduncle, or distinctly longer. Of the specimens examined, those from the west coast of Mexico and Panama Bay have the largest eyes; they agree fairly well with the description and figure of Bate's *P. processa* from Amboina, 15 fathoms.

¹ The type of *B. harrimani* has been compared with Dr. Holmes's description of *B. longidactylus* (Occas. Papers Calif. Acad. Sci., VII, 190, 1900), specimens of that species not being at hand.

To the localities recorded by me in 1901 (*loc. cit.*) may be added the following:

Cedar Keys, Florida, in seaweed, between tides, two forms as described above (H. Hemphill).

Trinidad (*Albatross*).

San Diego, California; feet of first pair chelate (D. S. Jordan).

Off Abreojos Point, Lower California, 48 fathoms (*Albatross* station 2834).

Gulf of California, 29-71 fathoms (*Albatross* stations 2998, 3011, 3014).

Panama Bay, 51½ fathoms (*Albatross* station 2805).

Range.—Europe; Madeira; Bermudas; from North Carolina to Trinidad, including Gulf of Mexico and West Indies; from San Diego, California, to Panama Bay; Japan; Amboina. Shallow water to 111 fathoms.

Family CRANGONIDÆ.

Genus Crangon Fabricius.

KEY TO THE SPECIES OF CRANGON.

- A. Gastric region not depressed below the general level of the carapace.
- B. Carapace with 1 or more median spines.
- C. Carapace with 1 median spine.
- D. Sixth segment of abdomen with 2 prominent longitudinal carinae *dalli*.
- D'. Sixth segment of abdomen not carinated.
- E. Sixth segment of abdomen sulcate beneath.
- F. Manus of first pair of feet very slender, four or more times as long as broad. Fifth abdominal segment with a posterior spine at the supero-lateral angles.
- G. Hand of male four and a half times as long as wide *franciscorum*.
- G'. Hand of male five and a half times as long as wide *franciscorum angustimana*.
- F'. Manus of first pair of feet not slender, less than three and a half times as long as wide.
- G. Fifth segment of abdomen not carinate.
- H. Blade of antennal scale having its anterior margin more advanced at its inner than its outer angle. Sixth segment of abdomen with a large circular spot on either side of its posterior end *nigromaculata*.
- H'. Blade of antennal scale having its anterior margin retreating toward the inner angle. Sixth segment of abdomen without a large circular spot *septemspinosa*.
- G'. Fifth segment of abdomen furnished with a superior median carina.
- H. Antero-internal angle of scale advanced, reaching

nearly as far as, or farther than, the spine.
Hands a little over twice as long as wide

nigricauda.

H'. Antero-internal angle of scale is not produced, and the spine reaches much beyond the blade.
Hands two and a half to three times as long as wide.

J. Scale shorter than the carapace, exclusive of rostrum *alaskensis*.

J'. Scale as long as the carapace, exclusive of rostrum *alaskensis elongata*.

E'. Sixth segment of abdomen convex, not sulcate, beneath.

F. Hands very stout, only two and a fourth times as long as wide; antepenult segment of outer maxillipeds greatly dilated *alba*.

F'. Hands elongate, about three and a half times as long as wide; antepenult segment of outer maxillipeds not dilated *holmesii*.

C'. Carapace with 2 median spines.

D. Both median spines in front of the middle of the carapace.

E. Rostrum slightly ascending, rounded at the tip. Surface pubescent *communis*.

E'. Rostrum ascending at an angle of 45 degrees, tip pointed. Surface naked.

F. Eyes of moderate size *resima*.

F'. Eyes very large *abyssorum*.

D'. Posterior of the median spines situated at about the middle of the carapace *intermedia*.

B'. Carapace without a median gastric spine *stylirostris*.

A'. Gastric region depressed below the general level of the carapace.

B. Second lateral carina of the carapace (counting from the middle) unarmed.

C. Rostrum not spiniform, extremity obtuse.

D. First to fourth abdominal segments, inclusive, smooth.

E. Anterior median spine not advanced so far as the line of the orbits *munita*.

E'. Anterior median spine projecting in front of the line of the orbits *acclivis*.

D'. First to fourth abdominal segments more or less carinated.

E. First to third segments of the pleon armed laterally with 2 spines each *spinossissima*.

E'. First to third segments of pleon unarmed *variabilis*.

C'. Rostrum spiniform, sharp *spinirostris*.

B'. Second lateral carina of the carapace armed with a spine a little behind the superior lateral spine *munitella*.

CRANGON NIGRICAUDA Stimpson.

Crangon nigricauda STIMPSON, Proc. Calif. Acad. Sci., 1, 97, 1856; Jour. Boston Soc. Nat. Hist., VI, 496, pl. XXII, fig. 6, 1857.

Crangon nigricauda HOLMES, Occas. Papers Calif. Acad. Sci., VII, 170, pl. II, fig. 31, 1900, but not all refs. to synonymy.

Carapace only a little more than one third the length of the abdomen, furnished with a single median gastric spine, and a hepatic spine, in a transverse line. Rostrum rather short, grooved, rounded at the tip. Suborbital and antennal spines present, the latter the larger.

The process on the outer side of the base of the antennules is broad, irregularly ovate, and about reaches the tip of the first joint; flagella longer than the peduncle, the inner one, and sometimes the outer one, exceeding the scale. Antennæ as long as, or longer than, the body, acicle about two thirds the length of the carapace, the antero-internal angle rounded and produced, reaching nearly as far forward as the spine at the outer angle (sometimes farther than the spine). The outer maxillipeds reach about as far forward as the antennal scale.

The first pair of feet may extend as far forward as the maxillipeds, or be a little shorter; merus with a spine near the middle of the lower side; hand oblong, a little more than twice as long as wide, with the edges subparallel; the margin against which the finger closes is regularly convex and more nearly transverse than longitudinal; spinous pollex directed obliquely forward. A spine on the sternum between the bases of the third pair of feet.

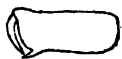


FIG. 30. *Crangon nigricauda*. Chela (X 23). Bodega Bay, Calif.

Antepenultimate segment of abdomen distinctly carinated in the middle; the sixth segment has a tendency to become carinated, and has a shallow median groove. Telson grooved above, subacute at tip, and exceeding the sixth plus one half of the fifth. An acute tooth on the sixth segment on either side of the base of the telson, and a spine at the postero-inferior angles, between which there is a median ventral spine curved backward; the posterior three fourths or more of the ventral surface of this segment is marked by a groove.

Color in life, dark gray with a blackish tail (Holmes).

Dimensions.—Length of female (Catalogue no. 3052) from tip of rostrum to tip of telson 68 mm., length of carapace 17 mm., of antennal scale 10.5 mm.

Distribution.—According to Holmes (who includes here *C. alaskensis*), this species ranges from Alaska to Lower California. I have seen specimens ranging only from Comox, British Columbia, southward, as follows:

Comox, British Columbia (*Albatross*).
Neah Bay, Washington, in drag seine (*Albatross*).
Puget Sound (T. Kincaid).

Bodega Bay, California (University of California).

San Francisco Bay, California (W. H. Dall; Livingston Stone).

San Francisco Bay, off San Mateo, 3 fathoms, dredged (*Albatross*).

San Francisco Bay, on South Belmont oyster beds, seine (*Albatross*).

San Francisco Bay, in San Pablo Bay, in Chinese shrimp nets (*Albatross*).

San Francisco Bay, off San Bruno Point, in Chinese shrimp nets (*Albatross*).

San Francisco market (R. E. C. Stearns).

Monterey (D. S. Jordan).

Catalina Island (*Albatross*).

San Diego (H. Hemphill; D. S. Jordan; *Albatross*).

San Diego Bay, $5\frac{3}{4}$ –12 fathoms (*Albatross* stations 3574, 3581, 3582, 3621).

Station 3674 of *Albatross* (locality not given), 31 fathoms.

San Geronimo Island, Lower California, 7 fathoms (A. W. Anthony).

Mogi, Japan (Dr. F. C. Dale, U. S. S. *Fulos*, June 18, 1881); one specimen without chelipeds, which otherwise corresponds closely with the American form; probably, however, distinct from *C. affinis* De Haan and *C. propinquus* Stimpson.

Monterey (Owen, as *C. vulgaris*).

CRANGON NIGROMACULATA Lockington.



FIG. 51. *Crangon nigromaculata*. Chela of ♀ (× 24). Station 3132.

Distribution.—From northern California to Lower California, 3–33 fathoms.

Specimens in the National Museum range from Gulf of the Farallones to San Diego, California; also found at Turtle Bay, Lower California.

CRANGON ALASKENSIS Lockington.

Crangon alaskensis LOCKINGTON, Proc. Calif. Acad. Sci., VII, 34 [7], 1876 (1877). Mutiny Bay, Alaska.

Differs from *C. nigricauda* as follows: The antennal scale is a little longer and much narrower distally; the end of the blade is rounded and not produced at the antero-internal angle; the spine is much longer, extending considerably beyond the blade.



FIG. 52. *Crangon alaskensis*. Chela of ♀ (× 34). Station 3652.

The first pair of feet are shorter, reaching only to the middle of the terminal segment of the maxillipeds; the hands are more slender and elongate, being from two and a half to three times as long as wide; their distal margin is more oblique, forming an angle of about forty-five degrees with the lengthwise margins.

Dimensions.—Length of large egg-bearing female from Kulukak Bay,



FIG. 53. *Crangon alaskensis*. ♀. Station 3943. a. Dorsal view of rostral region (× 24). b. Acicle (× 24).

Alaska (station 3243), 77.2 mm.; length of carapace 20.1 mm.; length of antennal scale 14 mm.

Distribution.—East part of Bering Sea and along the Aleutian Islands, in $3\frac{1}{4}$ –41 fathoms, at 38 stations of the *Albatross*.

Also taken at the following localities:

Off Kurile Islands, 14 fathoms (*Albatross* station 3652).

Gulf of Georgia, British Columbia, 67 fathoms (*Albatross* station 2863).

Sucia Island, British Columbia (*Albatross*).

Bellingham Bay, Washington, 11 fathoms (*Albatross* station 3612).

Strait of Fuca, 81 fathoms (*Albatross* station 3596).

Port Townsend, Washington, rostrum narrower than typical (*Albatross*).

Puget Sound (T. Kincaid).

From Sitka northward to Port Clarence and westward along the Aleutian Islands to Attu, 5–20 fathoms, at sixteen localities (W. H. Dall).

CRANGON ALASKENSIS ELONGATA Rathbun.

Crangon alaskensis elongata RATHBUN, Proc. U. S. Nat. Mus., xxiv, 888, 1902.

The typical *C. alaskensis* described above passes by insensible gradations into a form occurring off the coast of California and Oregon, which differs from it as follows: The rostrum is longer and narrower. The outer flagellum of the antennules falls considerably short of the antennal scale. The scale is much longer than in the typical form, being equal to the length of the carapace exclusive of the rostrum. The fourth segment of the abdomen shows signs of carination. The telson is flattened above, but scarcely grooved; its tip is more acute.



FIG. 54. *Crangon alaskensis elongata*. a. Stations 2970, 2971. b. Anterior part of carapace (X 24). c. Acicle (X 2).

Dimensions.—Length of ovigerous female from tip of rostrum to tip of telson 55.7 mm.; length of carapace 13.5 mm.; length of antennal scale 11.6 mm.

Type locality.—Off Santa Barbara, California, 29 fathoms, stations 2970, 2971 (*Albatross*).

Distribution.—This species occurs in abundance off the west coast of the United States. It has been taken by the *Albatross* at thirty stations in 9–278 fathoms, off California, Oregon, Washington, and British Columbia, and in Strait of Fuca and Puget Sound. The southern limit is off Wilmington, California. It has also been collected in Monterey Harbor by Dr. W. H. Dall, and at Pacific Grove by Mr. J. O. Snyder.

Variations.—The more northern of these specimens (those off the coast of Washington more especially) have the scale not quite so long as the types, but still equal to about four fifths the length of the carapace; the

rostrum, too, is often intermediate between typical *alaskensis* and typical *alaskensis elongata*.

CRANGON SEPTEMSPINOSA Say.

Crangon septemspinosus SAY, Jour. Acad. Nat. Sci. Phila., 1, 246, 1818.

Crangon crangon and *Crangon vulgaris* of authors (part).

Associated sometimes with *C. alaskensis*, which it closely resembles; it can be recognized at once by the rounded (non-carinated) abdominal segments. In Alaskan specimens the antennal scale is a little more than two thirds the length of the carapace; it is equal to or exceeds the distance from the gastric spine to the posterior margin; the extremity of the blade is obliquely subtruncate, slightly rounded, the antero-internal angle retreating; the spine surpasses the blade to a distance exceeding the anterior width of the blade. The hands are variable in length, being from three to three and one half times as long as wide; the obliquity of the terminal margin is as in *C. alaskensis*. All the abdominal segments are free from carinae; the sixth and seventh have a slight median sulcus.

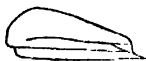


FIG. 55. *Crangon septemspinosus*. Acicle (X 2). Station 3230.

There is considerable variability in Atlantic specimens of this species, in the length both of the scale and of the hands; I cannot see that our Alaskan specimens differ essentially from those of Chesapeake Bay.

Dimensions.—Female, station 3230, length from tip of rostrum to tip of telson 60.4 mm., length of carapace 15.6 mm., length of antennal scale 11 mm.

Color.—It is probable that in life the species could readily be detected by the color markings. In alcohol the speckles of the dorsal surface are more uniform and closer than in *C. alaskensis*, and the telson and uropods are darker than in *C. alaskensis* from the same dredge haul.

Distribution.—This species is less abundant along the Alaskan coast than *C. alaskensis*; it extends from the Arctic coast of Alaska at Eschscholtz Bay southward along the eastern shore of Bering Sea to the Shumagins; the separate localities are as follows:

Chamisso Harbor, Eschscholtz Bay, 5–8 fathoms (W. H. Dall).

Port Clarence, in the seine, with *C. alaskensis* (W. H. Dall).

St. Michael, Norton Sound (L. M. Turner; E. W. Nelson).

Head of Norton Sound, 5 fathoms (Point Barrow Expedition).

Off mouth of Yukon, $3\frac{1}{2}$ fathoms (E. W. Nelson).

Cape Etolin, Nunivak Island, anchorage, 8 fathoms, stony (W. H. Dall).

Hagemeister Strait, 8–15 fathoms, gravel (W. H. Dall).

Bristol Bay (C. L. McKay).

Bristol Bay, $3\frac{1}{4}$ fathoms, with *C. alaskensis* (Albatross station 3230).

Bailey Harbor, Alaska Peninsula (*Albatross*).

Coal Harbor, Unga Island, Shumagins, 3 fathoms (W. H. Dall).

Also occurs along the eastern coast of North America, from East Florida (Say) northward.

It becomes necessary to separate the common *Crangon* of the Atlantic and Alaskan coasts of North America from the form found in Europe. These two species have usually been combined under the name *Crangon crangon* (Linnaeus) or *C. vulgaris* Fabricius.

In *Crangon crangon* (of Europe) the antennal scale is wider at its distal end, and that margin, although convex, trends forward toward the inner angle. The spine is shorter than the distal width of the blade.

In *Crangon septemspinosa* Say (of America) the scale is narrower at its distal end, and that margin, although convex, does not trend forward toward the inner angle, but rather slopes backward. The spine is as long as, or longer than, the distal width of the blade.

CRANGON ALBA Holmes.

Crangon alba HOLMES, Occas. Papers Calif. Acad. Sci., VII, 174, 1900. Monterey, dredged.

A short stout species. Carapace about two fifths as long as abdomen. Rostrum broader than in *C. nigricauda*. The first segment of the antennule exceeds the process on the outer side of its base; inner flagellum exceeding the antennal scale; outer flagellum shorter than the scale. Blade of scale with very oblique inner margin, the tip scarcely wider than the adjacent portion of the spine; spine extending considerably beyond the blade. Scale about three fourths the length of carapace.



FIG. 57. *Crangon alba*. Chela of ♀ (X 23). San Diego.

Maxillipeds reaching the end of the blade, the antepenult segment much expanded. The first pair of feet reach to the middle of the last joint of the maxillipeds; the hand is very stout, wider than in *C. nigricauda*, the length being two and one fourth times the width measured from the inner base of the immovable spine; the anterior margin is more longitudinal than transverse.

The segments of the abdomen are smoothly rounded; the sixth is rounded beneath, not grooved; the seventh is not sulcate above.

The segments of the abdomen are smoothly rounded; the sixth is rounded beneath, not grooved; the seventh is not sulcate above.

Dimensions.—An ovigerous female (station 3679) measures 48 mm. long, carapace 12.5 mm., scale 9.7 mm.

Distribution.—From Vancouver Island, British Columbia, to San Diego, California, to a depth of 47 fathoms, at the following localities:

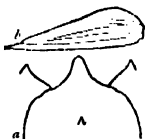


FIG. 56. *Crangon alba*. ♀. San Diego. a. Dorsal view of orbital region (X 4). b. Acicle (X 2).

Off Cape Beale, Vancouver Island, 34 fathoms, stations 2879, 2880.

Off Cape Flattery, Washington, 40 fathoms, station 2873.

Gulf of the Farallones, 29 fathoms, station 3100; 47 fathoms, station 3157.

Off Lobos Rocks, California, 41 fathoms, station 3185.

South of San Diego Bay, 22 fathoms, station 3679.

Off Cortez Bank, California, 47 fathoms, station 2922.

San Diego, depth not given (*Albatross*).

Pacific Grove, California (J. O. Snyder).

CRANGON HOLMESI Rathbun.

Crangon holmesi RATHBUN, Proc. U. S. Nat. Mus., XXIV, 888, 1902.

A small species allied to *C. alba* Holmes in not having a groove on the under side of the sixth abdominal segment.

Carapace a third as long as the abdomen; rostrum narrow-triangular, short, with a rounded tip. Antennulæ as in *C. alba*. Antennæ nearly as long as the body; scale either as long or nearly as long as the carapace exclusive of the rostrum; blade very narrow at the extremity; spine much exceeding it. Maxillipeds exceeding the scale a little; antepenult segment not dilated. The first pair of feet reach to the middle of the terminal joint of the maxillipeds; the hand is elongate, about

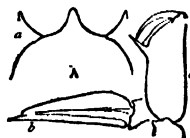


FIG. 58. *Crangon holmesi*.

9. Station 2939. a. Dorsal

view of rostral region ($\times 8$).

b. Acicle ($\times 4$). c. Chela ($\times 8$).

three times as long as wide; the anterior margin, against which the dactylus folds, is more longitudinal than transverse. The third pair of legs is a very little longer than the second; they are equally slender. The segments of the abdomen are smoothly rounded above; the sixth without a ventral sulcus; the seventh is a little longer than the sixth, or about as long as the antennal scale, and is exceeded by the uropods.

Dimensions.—Ovigerous female, length 23 mm., length of carapace 5.3 mm., of antennal scale 4.2 mm.

Distribution.—Off Wilmington, California, 27 fathoms (*Albatross* station 2939), type locality, 4 females.

Catalina Harbor, California, 30–40 fathoms, sandy mud; 1 female (W. H. Dall).

Northwest of Cerros Island, Lower California, 58 fathoms (*Albatross* station 2983), 4 females.

CRANGON STYLIROSTRIS Holmes.

Crangon stylirostris HOLMES, Occas. Papers Calif. Acad. Sci., VII, 174, pl. II, figs. 33–35, 1900.

Rostrum long, narrow, grooved above, tapering to a narrow-acute tip which is curved strongly downward and much compressed laterally. There is no median gastric spine; but with a lens one can discern a scabrous granule in the spot where the spine usually occurs. The antennular peduncle has shorter segments than in *C. alba*, to which this species is nearly related; outer branch of flagellum as long as, or longer than, the blade of the antennal scale. Antennæ shorter than the body. Scale shaped as in *C. alba*, but much shorter, being only a little over half as long as the carapace. Maxillipeds with the antepenult segment outwardly dilated as in *C. alba*. The hands are slightly widened distally, shorter and broader than in *C. alba*, the length being barely twice the width; the anterior margin is more transverse than longitudinal. Second pair of feet more slender and a little longer than the third.



FIG. 59. *Crangon stylirostris*. Chela ($\times 4$). Chirikof Island.

Abdominal segments smoothly rounded above, not carinated; sixth segment not sulcated below; seventh segment a very little longer than the sixth. The uropods extend considerably beyond the telson. Each segment in the male bears a median spine on the ventral side.

Dimensions.—Length of female 54 mm., of carapace 15.1 mm., of acicle 9.1 mm.

Distribution.—Santa Cruz, California, in seine, April 12, 1897 (*Albatross*); Trinidad, Humboldt Co., California (Holmes); Chirikof Island, Alaska, anchorage, 9–14 fathoms, sand (W. H. Dall).

CRANGON DALLI Rathbun.

Crangon dalli RATHBUN, Proc. U. S. Nat. Mus., XXIV, 889, 1902.

Rostrum rather long and narrow, sides parallel for a portion of their length, edges upturned. Second antennular segment about one and a half times as long as the third; inner flagellum exceeding the acicle; outer flagellum considerably shorter. Acicle about seven tenths as long as the carapace; blade obliquely subtruncate, inner angle rounded, receding; spine extending beyond the blade to no greater extent than the anterior width of the blade. The first pair of feet reach only to the middle of the terminal joint of the maxillipeds; the hands widen considerably from the proximal to the distal end; the distal margin is transversely oblique; the width of the palm is contained in its greatest length about two and two thirds times.



FIG. 60. *Crangon dalli*. ♂. Station 3287. a. Dorsal view of rostral region ($\times 3$). b. Acicle ($\times 9$). c. Chela ($\times 4$).

The first to fifth segments of the abdomen are smooth; the sixth has two blunt but prominent longitudinal carinae,

with a deep intervening sulcus; the seventh segment has a shallow median sulcus.

Dimensions.—Length of ovigerous female from tip of rostrum to tip of telson 61.5 mm., length of carapace 16.2 mm., of antennal scale 11.5 mm.

Type locality.—Bering Sea, off Cape Seniavin, Alaska, 30 fathoms (*Albatross* station 3287).

Distribution.—Bering Sea and Aleutian Islands to Sitka; Kamchatka, Okhotsk Sea, and Kurile Islands; in $4\frac{1}{2}$ –61 fathoms. Taken by the *Albatross* at 70 stations, by W. H. Dall at 15 stations; by Lieutenant G. M. Stoney, U. S. N., at 7 stations, by C. L. McKay at Bristol Bay. Occurs in large numbers in Bering Sea.

Bellingham Bay, Washington, 11 fathoms, 200 specimens (*Albatross* station 3612).

Bering Island, stomach of *Gadus macrocephalus*, 1 specimen (N. Greb-nitzky).

Rakovaya Bay, Avacha Bay, Kamchatka, 1 specimen (*Albatross*).

Off Robben Island, Okhotsk Sea, 18 fathoms, 1 specimen (*Albatross* station 3646).

Off Kurile Islands, 14 fathoms, 1 specimen (*Albatross* station 3652).

Affinities.—This species is analogous to *C. allmani* Kinahan of the North Atlantic, but in that species the rostrum is shorter and narrower, the antennal scale is shorter and the end of its blade more oblique, the hand is longer and its anterior margin is more longitudinal than transverse.

In the form of the carapace *C. dalli* resembles *C. alaskensis* and *C. septemspinosa*, with which it occurs, but is readily separated from them by the prominent carinae of the sixth abdominal segment and the shape of the hands, which in those species are oblong, but in *C. dalli* widen distally.

CRANGON FRANCISCORUM Stimpson.

Crangon franciscorum STIMPSON, Proc. Cal. Acad. Sci., 1, 97, 1856; Jour. Boston Soc. Nat. Hist., VI, 495, pl. XXII, fig. 5, 1857.—HOLMES, Occas. Papers Cal. Acad. Sci., VII, 172, 1900, and synonymy.

Carapace about three eighths as long as abdomen. Rostrum short, triangular, tip broadly rounded. Antennal flagella very unequal, the inner one longer than the antennal scale and greatly exceeding it, the outer one less than half as long as the scale. Scale about three fourths as long as the carapace, the blade broad and slightly rounded at the extremity, spine exceeding it, flagellum nearly as long as, or longer than, the body. Maxillipeds not attaining the end of the scale; first pair of

feet reaching the end of the maxillipeds; hand very long and narrow, the length from four to four and a half times the width, longer in male than in female, inflated near the base, outer margin concave for the most part, inner convex, dactylus when flexed almost longitudinal.



Abdominal segments smoothly rounded; fifth with a spine on either side of the posterior extremity at the supero-lateral angles. Sixth segment as in *C. nigricauda*; telson sharp.

Dimensions.—Length of male 77 mm., length of carapace 20.5 mm., of antennal scale 15 mm.

Distribution.—I have examined specimens from Thorn Arm, southeastern Alaska, in drag seine (*Albatross*). Promise Island, southeastern Alaska (*Albatross*). Loring, Revillagigedo Islands, southeastern Alaska (*Albatross*). Strait of Fuca (D. S. Jordan). Puget Sound (D. S. Jordan). Mouth Tenmile Creek, 10 miles south of Florence, Oregon (S. E. Meek, U. S. Fish Commission). Off Tillamook Rock, Oregon, 29 fathoms (*Albatross* station 2883). Off Yaquina Head, Oregon, 28 fathoms (*Albatross* station 3055). San Francisco Bay (*Albatross*): on South Belmont Oyster Beds, with seine; off San Mateo, 3 fathoms, with boat dredge; in San Pablo Bay, in Chinese shrimp nets; San Pablo Bay, 12 fathoms, station 3097; and off San Bruno Point, in Chinese shrimp nets. San Francisco Bay (various collectors). San Francisco market (R. E. C. Stearns). Pacific Grove, California (Stanford University). San Diego, California (H. Hemphill).

Previously known also from Shoalwater Bay, Washington, and Tomales Bay, California.

This form is represented in deeper waters by a form which I have called

CRANGON FRANCISCORUM ANGUSTIMANA Rathbun.

Crangon franciscorum angustimana RATHBUN, Proc. U. S. Nat. Mus., xxiv, 889, 1902.



FIG. 62. *Crangon franciscorum angustimana*. Chela of ♂ (X24). Station 3612.

Its chief difference lies in the shape of the hands, which are narrower than in *C. franciscorum*, the difference being less in the female; in the male the length is about five and a half times the width, the dactylus is more longitudinally placed, and the pollex is more transverse and nearer the proximal end of the hand.

FIG. 63. *Crangon franciscorum angustimana*. Chela of ♀ (X2). Station 3612.

Dimensions.—Length of female 70.6 mm., of carapace 18.9 mm., of antennal scale 13 mm. Length of hand of male 9.5 mm., width 1.8 mm. Length of hand of male of *C. franciscorum* 11 mm., width 2.6 mm.

Type locality.—Off Chuck-a-nuts Island, Bellingham Bay, Washington, 11 fathoms (*Albatross* station 3612).

Distribution.—British Columbia to Oregon as follows:

Gulf of Georgia, British Columbia, 67 fathoms (*Albatross* station 2863).

Washington Sound, Strait of Fuca, 48 fathoms (*Albatross* station 2864).

Strait of Fuca, 53–67 fathoms (*Albatross* stations 3460, 3597).

Admiralty Inlet, Puget Sound, 40 fathoms (*Albatross* station 2865).

Seattle, Washington, taken at the surface by electric light (*Albatross*).

Off Columbia River, 27 fathoms (*Albatross* station 3065).

Astoria, Oregon (Aug. C. Kinney).

Off Tillamook Rock, Oregon, 23–28 fathoms (*Albatross* stations 3060, 3061).

It will be noticed that the two forms meet off the coast of Oregon, where the differences are less sharply drawn.

CRANGON INTERMEDIA Stimpson.

Crangon intermedia STIMPSON, Proc. Acad. Nat. Sci. Phila., XII, 25 [94 of separate], 1860. In Bering Sea near Cape Chepoonski, 40 fathoms.

Crangon tenuifrons KINGSLEY, Bull. Essex Inst., XIV, 128, pl. 1, fig. 10, 1882. Marmot Island, Kadiak.

Carapace about two fifths as long as the abdomen; furnished with a median carina having 2 spines, a stout one about half way between the orbit and the posterior margin, and a smaller one a little behind the rostrum. Rostrum convex in profile, having a longitudinal sulcus and a rounded tip.

On the anterior margin there is a blunt spine at the outer angle of the orbit and a sharp spine at the antero-lateral angle. On a line with the orbital spine there is a smooth carina; below the carina a sharp spine well forward and terminating a short carina; higher up a flattened blunt spine or tubercle, situated about half way between the two median spines.

The antennal scale is short and broad, about half as long as the carapace; the spine scarcely exceeds the blade. The outer maxillipeds exceed the antennal scale by half the length, or more, of their terminal segment. The first pair of feet overreach the scale slightly; the merus has a short spine at the middle of its inner margin; the manus is about three times as long as wide; the pollex arises at about the distal third; the dactylus when flexed is slightly more longitudinal than transverse. The sternum has a lobate median crest, which in the male has a tendency to become spiniform.

The first five segments of the abdomen are distinctly carinated; the sixth segment has two prominent carinae.

Dimensions.—Length of female (*Albatross* station 3504) from tip of rostrum to tip of telson 45 mm.; length of carapace 12 mm.; length of antennal scale 6 mm.

Distribution.—Bering Sea and Aleutian Islands, 21–91 fathoms, at 31 stations of the *Albatross*; also off Vancouver Island, at 1 station in 24 fathoms; off coast of Kamchatka, 39–100 fathoms, at stations 3643 and 3781; usually in small numbers. Also taken by Dr. W. H. Dall at 6 stations between Adak and Kadiak, in 9–60 fathoms. Bering Island (N. Grebnitzky).

CRANGON COMMUNIS Rathbun.

Crangon communis RATHBUN, The Fur Seals and Fur-Seal Islands of the North Pacific Ocean, Pt. III, 556, 1899.

Carapace about a third as long as the abdomen; furnished with a median carina on the anterior half, which is armed with two spines, both in front of the middle; the posterior of these spines is the larger. The rostrum is slender, tapering, ascending, having a median sulcus, tip rounded, not extending beyond the eyes. A lateral spine nearly in line with the anterior of the median spines; two large spines on the anterior margin of the carapace, one of which is at the outer angle of the orbit, and the other at the antero-lateral angle.



FIG. 64. *Crangon communis*. ♀. Station 3611. a. Dorsal view of anterior part of carapace (X 2). b. Side view (X 2). c. Acicle (X 2). d. Chela (X 24).

The first segment of the antennular peduncle extends beyond the eyes to a distance exceeding the length of the last two segments; the second segment is about twice as long as the third. The antennal scale is elongate, about two thirds the length of the carapace; the spine is slender and exceeds the blade. The outer maxillipeds are very slender and extend slightly beyond the scale. The first pair of feet may not quite reach the scale or may extend beyond it; the merus has an outer distal spine; the manus is over three times as long as its average width; the immovable digit is long and slender, and the dactylus when flexed is obliquely transverse. The sternum has a series of median tubercles.

The abdomen is smoothly sculptured; there is a blunt median carina on the third to fifth segments; the first and second segments have a transverse sulcus; the third and fourth segments have each two transverse sulci, which are connected either side of the median carina; the sixth segment is furnished with two prominent longitudinal carinae, a median sulcus, and a sulcus on the outer side of each carina; the seventh

segment has a deep median sulcus. The abdominal sulci are filled with a thin short pubescence easily rubbed off. The sixth segment is about one and a third times as long as the fifth.

Dimensions.—Female (station 3441), length from tip of rostrum to tip of telson 64 mm., length of carapace 16 mm., length of antennal scale 10.5 mm.

Harriman Expedition.—Juneau, 20 fathoms.

Distribution.—From Bering Sea to San Diego, California (including Puget Sound and Strait of Fuca), 20–309 fathoms; taken at 142 stations by the *Albatross*, often in large numbers. Less abundant at southern localities. Off southeastern coast of Kamchatka, 96–100 fathoms, at two *Albatross* stations.

Two specimens were received from the Hopkins Laboratory at Pacific Grove; they were probably taken in deep water.

One specimen was collected at Port Etches, Alaska, in 12–18 fathoms, by W. H. Dall.

Variations.—The rostrum in normal individuals does not extend beyond the eyes; in many cases, however, it is evident that the rostrum has been broken off or injured and later renewed, the new rostrum having a narrow, elongated, and ascending tip exceeding the eyes, but of variable length. In other respects these abnormal forms do not differ from the types.

CRANGON RESIMA Rathbun.

Crangon resima RATHBUN, Proc. U. S. Nat. Mus., XXIV, 889, 1902.

Near *C. communis*. Carapace and rostrum a little more than one third the length of the abdomen; a median carina on the middle third of the carapace, armed with two spines, not far apart, the posterior larger and more elevated and in front of the middle. A sharp hepatic spine is in a transverse line with the anterior median spine and terminates a short but prominent carina. Rostrum long, narrow, pointed, advanced beyond the eyes, ascending at an angle of about forty-five degrees, slightly curved, and prolonged downward in a thin compressed plate which appears spatulate in a side view. The development of this

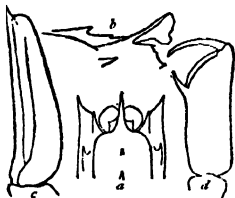


FIG. 65. *Crangon resima*. ♂. Station 2935. a. Dorsal view of anterior part of carapace (X 2). b. Side view of same (X 2). c. Acicula (X 3). d. Chela (X 4).

plate is dependent on age; specimens 20 mm. long show no evidence of it.

The second segment of the antennular peduncle is three times as long as the third; the scale on the outer side at the base is very thin and

rhomboidal, tipped with a short spine; the flagella are not very unequal in length, and exceed the antennal scale, but not the hair which fringes it. The antennal flagellum is longer than the body; the scale is four fifths of the carapace exclusive of the rostrum; its extremity is rather broad and slightly rounded, and is surpassed by the outer spine.

The maxillipeds are slender and reach beyond the scale; the first pair of feet extend to the middle of the last joint of the maxillipeds: they are similar to those of *C. communis*; the hands are shorter, three times as long as broad; their anterior margin, and also the dactylus when flexed, are more longitudinal than in *C. communis*.

The second and third pairs of feet are equally slender; the second pair is shorter than the first; the third pair is considerably longer than the first.

The first and second segments of the abdomen have a thickened band along the posterior margin, in front of which there is a slight transverse depression; the fifth segment has an obscure median carina with a short depression on either side at the anterior end; for the rest, the first five segments are smooth; the sixth has two prominent carinæ and a corresponding median depression; the telson is slender, and has a slight median sulcus; it exceeds the uropods.

Dimensions.—Length of ovigerous female (station 2935) from tip of rostrum to tip of telson 48.3 mm., length of carapace 12.2 mm., length of antennal scale 8.2 mm. Even females only 22.2 mm. long are laden with eggs.

Type locality.—Off San Diego, California, 124 fathoms (*Albatross* station 2935).

Distribution.—From Monterey Bay, California, to San Domingo Point, Lower California, station 3043; 44–266 fathoms, at 17 stations of the *Albatross*, usually in small quantities.

CRANGON ABYSSORUM Rathbun.

Crangon abyssorum RATHBUN, Proc. U. S. Nat. Mus., XXIV, 890, 1902.

Integument very thin, membranaceous.

Carapace and rostrum about two fifths the length of the abdomen. Carapace with three carinæ, extending nearly its whole length; median armed with 2 spines, one at the anterior third of the carapace (rostrum not included), the other minute, in front of the first. This small spine is often broken off. Rostrum linear, flattened above, acute, ascending at an angle of about thirty degrees with the carapace, and slightly curved, a little higher than wide, the lower part laterally compressed, in length about one fourth the remainder of the carapace. The

lateral carina extends backward from the orbital sinus. There is a strong hepatic spine at the end of a short carina; also a spine at the outer angle of the orbit and an antennal spine.

Eyes very large, hemispherical, their inner faces flat and contiguous, the carinae covering nearly all the outer face. Antennules rather slender;



FIG. 66. *Crangon abyssora* n. sp. (X 2). Station 3603. a. Dorsal view of anterior part of carapace. b. Side view of rostrum and dorsal spines. c. Acicle. d. Chela.

the scale at base is small, falcate, and acuminate, the second segment about one and a half times as long as the third; the flagella both exceed the antennal scale, the inner is only a little longer than the outer. The antennae have a slender spine at the outer base of the scale, which is narrow-oblong and about three fourths as long as the carapace (rostrum excluded); the blade is rounded at the end, and the spine projects beyond it; the peduncle

reaches to the distal third of the scale, its last joint is very slender, the flagellum is about as long as the body.

The maxillipeds are slender and exceed the scale by nearly half the length of the terminal segment. The first pair of feet do not reach the end of the scale. The merus has a small superior terminal spine. The manus widens a little distally; its length is three times its width measured at the inner base of the spine; the dactylus is more longitudinal than transverse. The second and third pairs of feet are equally filiform and delicate; the second reaches to the middle or beyond the middle of the palm of the first; the third reaches beyond the antennal scale; the fourth pair also exceeds the scale; the fifth pair is a little shorter. In the male the sternum has a median carina with a small spine on each segment.

The fifth segment of the abdomen has a low blunt carina; the sixth has two prominent dorsal carinae and a low lateral carina on each side near the dorsal, but extending only half the length of the segment; the telson has a median furrow on its anterior fourth; it exceeds the uropods.

Dimensions.—Length of female 61 mm., of carapace and rostrum 17 mm., of carapace exclusive of rostrum 13.5 mm., of antennal scale 10.3 mm.

Type locality.—Bering Sea, southwest of Pribilof Islands, 1771 fathoms (*Albatross* station 3603).

Distribution.—A deep-water species extending from Bering Sea to the southern extremity of California, in 685–1771 fathoms. Taken by the *Albatross* at the following localities:

Bering Sea, south of Pribilof Islands, 1401 fathoms, station 3604.

Bering Sea, southwest of Pribilof Islands, 1625 fathoms, station 3308.

Bering Sea, north of Rat Islands, 850 fathoms, station 3784.

Bering Sea, north of Unalaska, 987 fathoms, station 3607.

East of Prince of Wales Island, Alaska, 1569 fathoms, station 2859.

North of Islands of Four Mountains, Alaska, 1033 fathoms, station 3307.

Off Queen Charlotte Islands, British Columbia, 876 and 1588 fathoms, stations 2860, 3342.

Off Sea Lion Rock, Washington, 685 to 877 fathoms, stations 3069, 3071, 3074, 3075.

Off Cape Elizabeth, Washington, 831 fathoms, station 3344.

Off Tillamook Bay, Oregon, 786 fathoms, station 3346.

Off Cortez Bank, California, 984 fathoms, station 2919.

This species in general appearance much resembles a *Pontophilus*.

CRANGON MUNITA Dana.

Crangon munitus DANA, Crust. U. S. Expl. Exped., 1, 536, 1852; pl. XXXIII, fig. 5, 1855.

Female.—Body short and thick. Carapace less than two fifths the length of the abdomen; the anterior and middle portion of the carapace is depressed and pubescent; this depressed area is defined by a curved line extending backward from the antero-lateral angle nearly to the posterior margin on the median line, and is crossed in part by nine carinae. The median carina is the length of the depression and is armed with two spines, one at two fifths

the distance from the posterior margin, the other at an equal distance from the first. First lateral carina short, terminating in a spine half way between the two median spines. Second

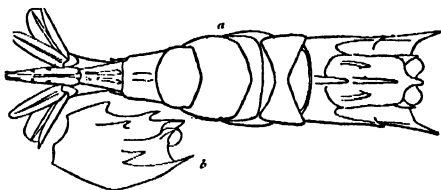


FIG. 67. *Crangon munitus*. ♂ ($\times 2$). Station 2881. a. Dorsal view of carapace and abdomen. b. Side view of carapace.

lateral carina as long as the dorsal depression, and unarmed except for the spine at the anterior end, which marks the outer angle of the orbit. Third lateral carina short, terminating in a spine half way between the superior lateral spine and the anterior median spine. Fourth lateral carina forming the boundary of the depression and terminating in a spine at the antero-lateral angle of the carapace. Rostrum short, reaching to a line between the tips of the orbital and the antero-lateral spines; nearly horizontal, medially sulcate, tip rounded.

The scale at the base of the antennules is broad, has a straight outer margin, and is tipped with a small spine. The first and second segments of the peduncle have a blunt spine at the outer distal angle, that on the

second segment reaching the distal end of the third segment; the flagella are unequal, both exceed the antennal scale. The antennal peduncle reaches nearly to the end of the scale; the scale is short and broad, the blade is rounded at the end, strongly advanced at the antero-internal angle, and greatly exceeds the spine; the flagellum is one and a half times the length of the carapace.

The maxillipeds surpass the antennal scale by nearly the whole length of the last segment. The first pair of feet are shorter than the maxillipeds but longer than the scale. Hands oblong, narrowing a little distally, or presenting a slight constriction at the base of the spine; three times as long as wide; anterior margin slightly longitudinal; spine short. The second and third pairs of feet are equally long, and shorter than the first pair; the fourth is shorter than the third, the fifth still shorter.

The first to fourth segments of the abdomen are dorsally smooth; the fifth has a faint blunt median carina; the sixth is about one and a third times the length of the fifth and has four blunt carinae, two of which are submedian; the lateral carinae converge posteriorly; the posterior superior angles are armed with a strong spine, the inferior with a small spine; the telson has a deep median sulcus; the ridges on either side of it are armed with two pairs of spinules; the tip is triangular, pointed.

The male differs from the female as follows: The spine at the antero-lateral angle is longer and more slender, and is sometimes directed outward. The median carina is strong even to the posterior margin of the carapace, and its spines are higher. The maxillipeds are shorter, exceeding the scale by only half the length of the terminal segment. The carinae of the fifth and sixth abdominal segments are stronger. The ventral surface of the thorax has a thin, strongly projecting carina, cut into four large saw-teeth. Each segment of the abdomen, except the last, has a median ventral spine.

Dimensions.—Male (station 2881), length of body 32.6 mm., of carapace 9.1 mm., of antennal scale 4.2 mm. Female with eggs, length of body 36.2 mm., of carapace 10 mm., of scale 4 mm.

Distribution:

Port Etches, Alaska, 12–18 fathoms (W. H. Dall).

Off Cape Beale, Vancouver Island, British Columbia, 24–34 fathoms (*Albatross* stations 2879–2881).

Puget Sound (Dana, Walker; also collected by T. Kincaid).

Off Point Conception, California, 31 fathoms (*Albatross* station 2908).

Off San Miguel Island, California, 53 fathoms (*Albatross* station 2894).

Dana describes the abdomen as smooth; the carina of the fifth segment is very indistinct in the female, while Dana in his figure indicates two carinae on the sixth segment.

CRANGON ACCLIVIS Rathbun.

Crangon acclivis RATHBUN, Proc. U. S. Nat. Mus., XXIV, 890, 1902.

Allied to *C. munita*. Lower lateral spine of carapace farther back; anterior median spine much larger and farther forward; it projects well in front of the posterior line of the orbits. The rostrum is narrower, and ascending at an angle of about forty-five degrees. The anterior margin of the hand is more longitudinal than in *C. munita*. The divisions of the ventral carina of the thorax in the male are much more spiniform in this species.

Dimensions.—Length of male 24.8 mm., length of carapace 7.4 mm., of antennal scale 3 mm.

Type locality.—Off Santa Cruz Island, California, 266 fathoms (*Albatross* station 2948), 1 male.

Distribution.—Off the Trinity Islands, Alaska, 159 fathoms (*Albatross* station 2853); Santa Catalina Island, California, 80 fathoms (*Albatross* station 3664); southwest of San Nicholas Island, California, 158 fathoms (*Albatross* station 2898). One specimen taken at each locality.

In the foregoing species the first four segments of the abdomen are smooth. We now come to a group also resembling *C. munita* in general appearance, but having the abdomen in front of the fifth segment more or less carinated.

CRANGON VARIABILIS Rathbun.

Crangon variabilis RATHBUN, Proc. U. S. Nat. Mus., XXIV, 890, 1902.

The carapace is much like that of *C. munita*, but is nearly half as long as the abdomen. The rostrum is short, convex from behind forward

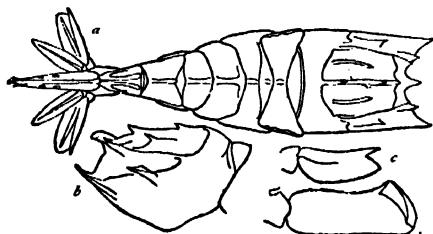


FIG. 69. *Crangon variabilis*. ♀. Station 2842. a. Dorsal view of carapace and abdomen (X 2). b. Side view of carapace (X 2). c. Acicle (X 4). d. Chela (X 4).

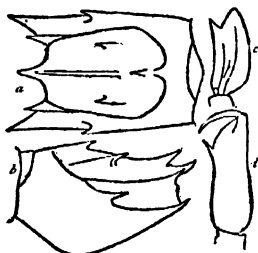


FIG. 68. *Crangon acclivis*. a. Dorsal view of carapace. ♂ (X 4). Station 2918. b. Side view (X 4). c. Acicle. ♀ (X 8). d. Chela. ♀ (X 8).

and the tip rounded and thickened. The antennal scale has a concave outer margin and the spine equals or extends beyond the blade. The chelipeds are stouter; the hands vary from two and a half to three times as long as wide. The second, third, fourth, and

fifth, and sometimes the first, segments of the abdomen are carinated, and (except on the first two) the carina usually high, laterally compressed, and blunt. The lateral spinules of the telson are considerably behind the middle of the segment. The median spines or teeth of the ventral side of the thorax in the male are laminar and dentiform; the anterior one has an acuminate, the others an acute, tip.

Dimensions.—Female, length of body 32.2 mm., of carapace 9.2 mm., of hand 5.6 mm., width of hand 2 mm. Male, length of body 24.6 mm., of carapace 7 mm., of hand 4.1 mm., width of hand 1.5 mm.

Type locality.—Off North Head, Akutan Island, Alaska, 72 fathoms (*Albatross* station 2842).

Distribution.—Bering Sea, Alaska Peninsula, and Aleutian Islands; California; 50–695 fathoms. Taken by the *Albatross* at the following stations:

Bering Sea, off the Pribilof Islands, 81–184 fathoms, stations 3486, 3488, 3489, 3500, 3602.

Off Rat Islands, 55 fathoms, station 3599.

North of Unalaska, 225 fathoms, station 3227.

Off Akutan Island, 91 fathoms, station 3548.

Northwest of Unimak Island, 121 fathoms, station 3224.

Unimak Pass, 50–56 fathoms, stations 3222, 3223.

Off Davidson Bank, 280 fathoms, station 3337.

South of Sannak Islands, 483 fathoms, station 3210.

Off Shumagin Bank, 625 and 138 fathoms, stations 3338, 3339.

Southeast of Chirikof Island, 695 fathoms, station 3340.

Off the Trinity Islands, 159 fathoms, station 2853.

Southwest of San Nicholas Island, California, 158 fathoms, station 2898.

Variations.—There is more variation in this species than is usual in this genus, perhaps owing to the great bathymetrical range.

The rostrum is often much thickened and elevated, the median sulcus being almost obliterated.

The hand is not of uniform proportion. It is a little longer in the male than in the female, and varies in specimens of the same sex from different localities. The median abdominal carina is in general less strong on specimens from deeper water.

These differences are not constant enough to warrant the division of this species.

CRANGON SPINOSISSIMA Rathbun.

Crangon spinosissima RATHBUN, Proc. U. S. Nat. Mus., XXIV, 891, 1902.

The relation of this species to *C. variabilis* is similar to that which *C. acclivis* bears to *C. munila*. The lower lateral spine of the carapace is more nearly in line with the superior lateral spine; the anterior median

spine is larger and farther forward, advancing to a line in front of the rear line of the orbits; the antero-lateral spine is longer and slenderer and bent more outward; the rostrum is narrower, longer, and acute, and ascends at an angle equal to that of the spine directly behind it; the spine

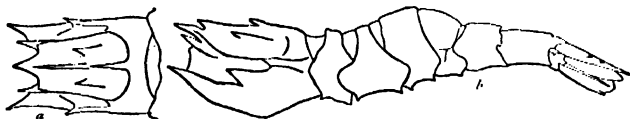


FIG. 70. *Crangon spinosissima*. ♀ (× 2). Station 3357. a. Dorsal view of carapace. b. Side view.

of the antennal scale is much shorter than the blade; the hand is longer and narrower, and its anterior margin more longitudinal; the spines of the ventral surface of thorax and abdomen are long and slender. This species furthermore differs from those hitherto described in having the segments of the pleon armed laterally with spines, the first three segments with two spines each, the next three with one spine each at the postero-lateral angle; the sixth segment also with a slender spine at the postero-superior angle.

Dimensions.—Female, length of body 36 mm., of carapace 10.5 mm. Male, length of body 34.6 mm., of carapace 10 mm. Length of hand loose in bottle 5 mm., width 1.4 mm.

Type locality.—Off Point Arena, California, 51 fathoms (*Albatross* station 3351).

Distribution.—Off Oregon and California, 51–96 fathoms: Off False Tillamook, Oregon, 62 fathoms, station 3090. Off Point Conception, California, 96 fathoms, station 2906.

CRANGON SPINIROSTRIS Rathbun.

Crangon spinirostris RATHBUN, Proc. U. S. Nat. Mus., XXIV, 891, 1902.

Also allied to *C. munita* and its associates, but differing from them all in its long spiniform rostrum.

The position of the spines of the carapace is similar to that in *C. munita*. The rostrum and the spine behind are long, slender, and suberect, the rostrum the longer. The orbital spine is slender and ascending; the antero-lateral spine is directed upward and outward. The spines of the first two antennular segments are slender; that of the antennal scale is longer than usual, exceeding the blade. The hand is about three times as long as wide. Of the projecting plates on the ventral surface of the thorax in the male, the



FIG. 71. *Crangon spinirostris*. ♀ (× 2). Station 3329. a. Dorsal view of carapace. b. Side view.

anterior has an acuminate, the other a spiniform, tip. The third to fifth segments of the abdomen are carinated; the anterior pair of lateral spinules of the telson are two fifths the distance from the tip.

Dimensions.—Female, length of body 35.4 mm., length of carapace 10.5 mm., of scale 4.4 mm., of hand 5.2 mm., width of hand 1.8 mm. Male, length of body 33 mm., length of carapace 10.3 mm., of scale 3.9 mm.

Distribution.—Bering Sea and off the Aleutian Islands, 276–625 fathoms, as follows:

North of Rat Islands, 270 fathoms (*Albatross* station 3785).

South of Pribilof Islands, 276 fathoms (*Albatross* station 3608).

Off Iliuliuk Harbor, Unalaska, 309 fathoms (*Albatross* station 3316).

North of Unalaska, 350–406 fathoms, stations 3329 (type locality) to 3332.

Off Shumagin Bank, 625 fathoms, station 3338.

CRANGON MUNITELLA Walker.

Crangon munitellus WALKER, Trans. Liverpool Biol. Soc., XII, 275, pl. XVI, fig. 1, 1898. Puget Sound.—HOLMES, Occas. Papers Calif. Acad. Sci., VII, 176, 1900.

This species is related to *C. munitus*, but differs from it and all its allies in having the second lateral carina from the middle armed with a spine a little behind the superior lateral spine. The distance between the two median spines is equal to the distance between the posterior of these spines and the posterior margin. The antero-lateral angle of the carapace is armed with a spine. The end of the blade of the antennal scale is so produced at the inner angle that it is more advanced than the spine at the outer angle. The first four abdominal segments are smooth; the fifth has a carina faintly indicated; the sixth has a broad, smooth carina set off by a depression on either side; the seventh has a slight median depression. The hands of the first pair of feet are two and a half times as long as wide, oblong, swollen, the anterior margin more longitudinal than transverse, spine very long.

Dimensions.—Female with eggs, length 25 mm., length of carapace 7 mm.

Distribution.—Puget Sound (Walker, Calman; also collected by T. Kincaid); Pacific Grove, California (J. O. Snyder); Catalina Harbor, California, 30–40 fathoms, sandy mud (W. H. Dall).

Genus *Sclerocrangon* Sars.

KEY TO THE SPECIES OF *SCLEROCRANGON*.

- A. A long suberect spine situated on the rostrum; four spines on median carina *sharpi*.

- A'. No long suberect spine situated on the rostrum; fewer than four spines on median carina.
 B. Carapace elongate, about one fifth longer than wide; blade of antennal scale considerably overreaching the spine . . . *boreas*.
 B'. Carapace nearly as long as wide; blade of antennal scale not overreaching the spine *alata*.

SCLEROCRANGON BOREAS (Phipps).

Cancer boreas PHIPPS, Voyage North Pole, 190, pl. XII, fig. 1, 1774.
Crangon Boreas SABINE, in Suppl. to Appendix of Capt. Parry's [First] Voyage, p. ccxxxv, 1824.
Sclerocrangon boreas SARS, Den Norske Nordhavs-Expedition, XIV, Zoologi, Crust., Pt. 1, p. 15, 1885.—HOLMES, Occas. Papers Calif. Acad. Sci., VII, 177, 1900, and synonymy.

Carapace one fifth longer than wide; three equidistant spines on the dorsal carina; a tuberculated carina on the branchial regions armed with an anterior spine and one or two obscure teeth. Rostrum triangular, acute; tip horizontal. Antero-lateral angles armed with a spine projecting forward or a little outward. Blade of antennal scale much produced beyond the spine. Hand twice or more than twice as long as wide; distal margin obliquely transverse; spine obliquely longitudinal. The merus has an upper distal spine, the carpus a lower distal spine.

Abdomen sculptured, the anterior segment with a median dorsal carina which forms a forward projecting tooth on the first segment; the sixth segment with a double carina, with a sulcus between the ridges; also on each side of the posterior margin a supero-lateral spine. Pleura of the abdominal segments with only one spine each. Telson sulcate; two pairs of lateral spinules on the terminal half.

Dimensions.—Male (Alaska), length 110 mm., length of carapace 32 mm., width of carapace at branchial spine 26.4 mm., length of hand 13.2 mm., width of hand at inner base of spine 6 mm.

Hurriman Expedition.—Kadiak, 5 fathoms (W. R. Coe); Berg Bay, Glacier Bay.

Distribution.—Arctic Europe and America; Atlantic coast of America southward to Cape Cod; Alaska (as far south as Killisnoo); 'California' (Ross, Owen); Siberia; Kamchatka (Ross). Depth, 1-44 fathoms.

Numerous specimens were taken by the *Albatross* in Bristol Bay and vicinity in $3\frac{1}{4}$ -17 fathoms; by the U. S. R. S. *Corwin* in lat. $66^{\circ} 12' 00''$ N., long. $168^{\circ} 54' 00''$ W., 30 fathoms, lat. $65^{\circ} 49' 15''$ N., long. $169^{\circ} 04' 30''$ W., 26 fathoms, and lat. $71^{\circ} 02' 00''$ N., long. $157^{\circ} 46' 00''$ W., 19 fathoms.

Killisnoo, Alaska (Northwestern Trading Company).
 Plover Bay, Siberia, 10-25 fathoms (W. H. Dall).

Cape Etolin, Nunivak Island, 8 fathoms (W. H. Dall).

Various localities in the Aleutians and Alaska Peninsula, 6–28 fathoms (W. H. Dall).

SCLEROCRANGON ALATA Rathbun.

Plate III, fig. 2.

Sclerocrangon alata RATHBUN, Proc. U. S. Nat. Mus., XXIV, 891, 1902.

Allied to *S. boreas*. Carapace only slightly broader than long; surface very uneven, sculptured and pitted. Median carina armed with a small

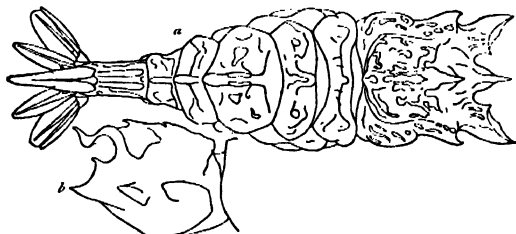


FIG. 72. *Sclerocrangon alata*. ♀ (× 2). Station 2865. a. Dorsal carapace and abdomen. b. Side view of carapace.

spine just behind the orbits, a still smaller one at the middle of the carapace, and a tubercle near the posterior margin. Rostrum with an acute upturned and curved tip. A

spine at the outer angle of the orbit. Antero-lateral angles broadly alate. Branchial carina having a strong anterior spine; posterior half protuberant and deeply pitted, as is also the surface below the crest. The spine of the antennal scale extends as far as or a little farther than the blade.

The first pair of feet have a strong upper distal spine on the merus, a large outer dentiform expansion on the carpus, and a very short stout hand less than twice as long as broad, the anterior margin nearly transverse and the spine nearly longitudinal.

The abdomen is sculptured.

The median carina of the first five segments is very blunt, and on the third segment especially prominent. The pleura are without spines. The lateral spinules (one or two pairs) on the telson are situated at about its middle.

Dimensions.—Male, length 38 mm., length of carapace 11 mm., width of carapace at branchial spine 10.7 mm., length of hand 4.4 mm., width of hand 2.5 mm. A female 25.7 mm. long is laden with ova.

Distribution.—From Bering Sea to Puget Sound, 6–91 fathoms. Usually not more than one or two specimens in a haul.

Taken at the following localities by the *Albatross*:



FIG. 73. *Sclerocrangon alata*. ♀ (× 34). Station 2865. a. Acicle. b. Chela.

Bering Sea, off Akutan Island, 36 and 91 fathoms, stations 3546 and 3548.

Northwest of Unimak Island, 43 fathoms, station 3262.

Off south entrance to Akutan Pass, 45 fathoms, station 2843.

Southwest of Sannak Islands, 41 fathoms, station 3213.

Shumagins, 21 and 35 fathoms, stations 2850 and 2851.

Strait of Fuca, 37 fathoms, station 3593.

Admiralty Inlet, Puget Sound, 40 fathoms, station 2865 (type locality).

By Dr. W. H. Dall at:

Constantine Harbor, Amchitka, 6-10 fathoms.

Bay of Islands, Adak, 9-16 fathoms.

Captains Harbor and Iliuliuk Harbor, Unalaska, 9-15 fathoms.

Belkofski Bay, 15-25 fathoms.

Coal Harbor, Unga, 8-9 fathoms.

Popof Strait, Shumagins, 6 fathoms.

Chiniak Bay, Kadiak.

By N. Grebnitzky, at Bering Island, from stomach of *Gadus macrocephalus*.

SCLEROCRANGON SHARPI (Ortmann).

Plate III, figs. 1, 1a.

Paracrangon echinatus SHARP (non Dana), Proc. Acad. Nat. Sci. Phila., 1893, 126.

Crangon (Sclerocrangon) sharpi ORTMANN, Proc. Acad. Nat. Sci. Phila., 1895, 178.

Carapace about as broad as long, with three keels, the median one with four strong spines, the first longest and placed on the upper margin of the rostrum, the second nearly as long and situated immediately behind the base of the rostrum; the first, third, and fourth spines are directed obliquely upward and forward, the second directly upward or a little backward. The rostrum is short, not reaching the end of the first antennular segment, sharp and curved upward. The lateral keels are formed by four spines; the foremost, on the anterior margin of the carapace near the base of the antennæ, is the largest, and is directed obliquely outward and forward, more than half as long as carapace; the three others are smaller but sharp. There is a sharp spine at the outer angle of the orbit and another on the outer side of the antenna at the base of the scale.

Merus of first pair of feet with a strong superior terminal spine; carpus with an outer, an inferior, and a smaller inner spine; hand more than twice as long as broad; anterior margin nearly transverse; spine short.

The abdomen is sculptured, first to sixth segments with a median keel, that of the third arched and produced somewhat posteriorly, that on the third to sixth segments with a median furrow, that of the sixth terminat-

ing in two spines. Two other spines are placed at the posterior margin of this segment, one on each side. Fifth segment furnished with a sharp spine on the posterior margin near the median line; also a small spine on the lateral surface. Lateral faces of the first five segments sculptured by two irregular transverse furrows, sixth segment laterally with an indistinct longitudinal ridge. Pleura of first to fourth segments triangular, inferior angles blunt, without spines. Sternal crest low, dentate, terminating anteriorly in a spine.

Dimensions.—Female, length 36.7 mm., length of carapace 11.5 mm., width of carapace between tips of antero-lateral spines 10.4 mm.

Distribution.—Bering Sea, Aleutian Islands, and Alaska Peninsula, 35–150 fathoms. Taken by the *Albatross* at the following stations:

Off Pribilof Islands, 54 and 150 fathoms, stations 3552, 3486.

Pumicestone Bay, Unalaska, and vicinity, 35 and 59 fathoms, stations 3322, 3319.

Off North Head, Akutan Island, 56 and 72 fathoms, stations 2841, 2842.

Off south entrance to Akutan Pass, 45 fathoms, station 2843.

Northwest of Unimak Island, 43 fathoms, station 3262.

Portlock Bank, 51 fathoms, station 2857.

Marmot Isle, Kodiak, 45 fathoms (Sharp).

Genus *Nectocrangon* Brandt.

KEY TO THE SPECIES OF NECTOCRANGON.

- A. Carapace with only two median spines behind the anterior margin.
 - B. Carinae of sixth segment of abdomen not terminating in a small sharp tooth or spine *lar*.
 - B'. Carinae of sixth segment terminating in a small sharp tooth or spine.
 - C. All the abdominal segments carinated.
 - D. Eyes with low tubercle. Spines of carapace appressed; those on anterior margin short. Hand elongate, about five times as long as wide *dentata*.
 - D'. Eyes with elongated sharp tubercle. Spines of carapace suberect; those on anterior margin long, slender. Hand shorter, only three and a half to four times as long as wide *ovifer*.
 - C'. The first and second abdominal segments not carinated *californiensis*.
- A'. Carapace with three or four median spines behind the anterior margin.
 - B. Carinae of sixth segment of abdomen terminating posteriorly in a small spine *alaskensis*.
 - B'. Carinae of sixth segment of abdomen not terminating posteriorly in a small spine.
 - C. First to fourth segments of abdomen carinated *crassa*.
 - C'. First to fourth segments of abdomen not carinated *levior*.

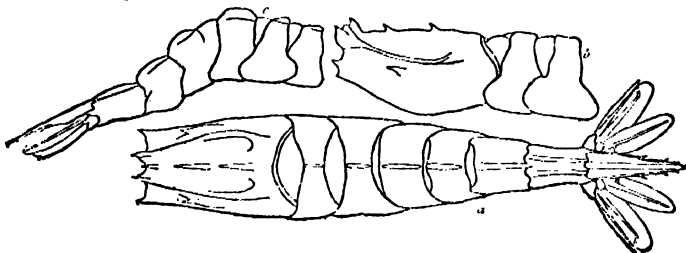
NECTOCRANGON LAR (Owen).

Crangon lar OWEN, in Zoology of Capt. Beechey's Voyage [of the *Blossom*], Crustacea, p. 88, pl. XXVIII, fig. 1, 1839.

Argis lar KRÖYER, Naturh. Tidssk., IV, 255, pl. v, figs. 45-62, 1842.

Nectocrangon lar STIMPSON, Proc. Acad. Nat. Sci. Phila., 25, 1860.—ORTMANN, Proc. Acad. Nat. Sci. Phila., 181, 1895.

Female.—Carapace about two fifths or one third as long as the abdomen; two spines on the median line, the distance between them being greater than the distance from the anterior spine to the anterior margin, and about equal to or less than the distance from the posterior spine to



b. Side view of carapace and part of abdomen (X 13). Station 3779.

a. (nat. size). Station 3642.

the posterior margin. Sometimes there is a tubercle behind the rostral spine. A low blunt irregular carina runs from the orbit nearly to the posterior margin; below this a spine on either side; a short antennal spine on the anterior margin. Blade of antennal scale exceeding the spine.

Hands of first pair of feet from three and a half to four times as long as the width of the palm. The anterior margin forms an angle of about forty-five degrees with the side margins. First to fifth abdominal segments furnished with a sharp median carina; sixth segment with two sharp carinae, which toward the posterior end become lower and may disappear altogether in front of the posterior margin. Pleura of first four segments with rounded entire angles; fifth and sixth segments with an acute tooth or small spine at the postero-inferior angles; sixth segment with a supero-lateral spine on each side of the posterior margin. Seventh segment with two blunt carinae armed with three pairs of spinules on the terminal half.



FIG. 75. *Nectocrangon lar* (X 13). a. Anterior margin of carapace. b. Chela. c. Chela. Station 3642.

Dimensions.—Female, length 79.2 mm., length of carapace 21.5 mm.

Male.—The male differs markedly from the female. It is much smaller. The eyes are considerably larger. The anterior margin of the hand is

more transverse, making the palm appear longer. The abdominal carinae are higher and thinner, especially on the third segment; the infero-posterior angle of the fourth segment may have a small spine. The abdomen is more elongate, notably the sixth segment.

Dimensions.—Large male, length 55.7 mm., length of carapace 13.6 mm.

Distribution.—Arctic coast of Alaska and Siberia southward to Sitka and Kurile Islands; Greenland (Kröyer). Beach to 47 fathoms.

In the U. S. National Museum this species is represented by numerous specimens ranging from the Arctic coast of Alaska and Siberia southward via Bering Strait to Bering Sea, lat. $56^{\circ} 12' 00''$ N. Within these limits it is very abundant and was taken at 21 stations of the *Albatross*, at 8 stations by Lieutenant G. M. Stoney, U. S. N., at 7 stations by W. H. Dall, at 2 stations by the U. S. R. S. *Corwin*, off the mouth of the Yukon by E. W. Nelson, and at Cape Smith by the Point Barrow Expedition.

Also taken at the following localities:

Shahafka Cove, Kadiak, 12–14 fathoms (W. H. Dall).

Sitka Harbor, 15 fathoms (W. H. Dall).

Avacha Bay, Kamchatka (L. Stejneger and *Albatross*; also recorded by Stimpson).

Rakovaya Bay, Avacha Bay (*Albatross*).

Off Kamchatka, 12–13 fathoms (*Albatross* stations 3776, 3777, 3779, 3780).

Off Iturup Island, Kurile Islands, 14–18 fathoms (*Albatross* stations 3652, 3653).

Off Robben Island, Okhotsk Sea, 18–20 fathoms, stations 3646, 3647.

NECTOCRANGON DENTATA Rathbun.

Nectocrangon lar SMITH, Trans. Conn. Acad. Arts Sci., v, 61, 1879 (part); not *N. lar* (Owen).—RATHBUN, The Fur Seals and Fur-Seal Islands of the North Pacific Ocean, Pt. III, 556, 1899 (part).—HOLMES, Occas. Papers Calif. Acad. Sci., VII, 178, 1900 (part).—ORTMANN, Proc. Acad. Nat. Sci. Phila., 1901, 164 (part).

Nectocrangon dentata RATHBUN, Proc. U. S. Nat. Mus., XXIV, 892, 1902.

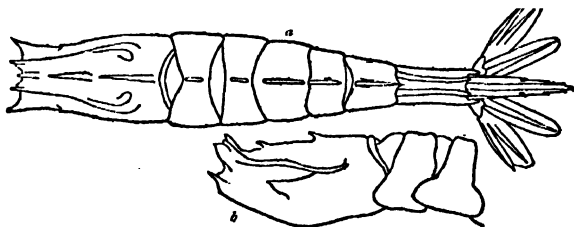


FIG. 76. *Nectocrangon dentata*. ♀ ($\times 14$). Station 3216. a. Dorsal view of carapace and abdomen. b. Side view of carapace and part of abdomen.

The typical *Nectocrangon lar* is primarily an Arctic species, and is replaced in the Aleutian Islands and the southern part of Bering Sea by a species which is very closely allied, and has been heretofore united with *N. lar*. It differs chiefly in the carinæ of the sixth abdominal segment terminating posteriorly in a small sharp tooth or spine. The hand is more elongate, being about five times or more than five times as long as its width across the palm.



FIG. 77.
Nectocrangon
dentata.
($\times 1\frac{1}{2}$). Sta-
tion 3216. a.
Acicle. b.
Chela.

Dimensions.—Female, length 73 mm., length of carapace 19 mm., length of hand 10 mm., width of palm 2.1 mm.

Type locality.—Off Sitkalidak Island, Alaska, 69 fathoms (*Albatross* station 2855).

Distribution.—Bering Sea southward to Sitka and southeast coast of Kamchatka; Atlantic coast of North America from Greenland to Nova Scotia, 6 to 96 fathoms.

From Bering Sea, in lat. $59^{\circ} 55' 00''$ N., southward to Aleutian Islands and Alaska Peninsula, at 65 stations of the *Albatross*, 21–93 fathoms.

Southeast coast of Kamchatka, 96 fathoms (*Albatross*).

Aleutian Islands eastward to Sitka Harbor, 6–80 fathoms (W. H. Dall). Plover Bay, Siberia, 10–25 fathoms (W. H. Dall).

It will be noticed that the habitats of *N. lar* and *N. dentata* overlap in Bering Sea, that each is occasionally found at the extreme limit of the other's range (e.g., *N. lar* at Kadiak and Vancouver Island, and *N. dentata* at Plover Bay), and that *N. dentata* extends into deeper water.

The species recorded from the North Atlantic by Professor S. I. Smith, under the name *N. lar*, is, I think, identical with *N. dentata*. The same form was collected by the Princeton Expedition at Greenland; specimens from Granville Bay are in the National Museum.

NECTOCRANGON OVIFER Rathbun.

Nectocrangon lar RATHBUN, The Fur Seals and Fur-Seal Islands of the North Pacific Ocean, Pt. III, 556, 1899 (part).

Nectocrangon ovifer RATHBUN, Proc. U. S. Nat. Mus., XXIV, 892, 1902.

In the deeper waters of Bering Sea there lives another species of *Nectocrangon* closely allied to *N. lar* and *N. dentata*. Like them, it bears two median spines on the carapace; the median crest is, however, higher, and the spines more ascending; the three spines of the anterior margin above the eyes are longer and more deeply separated from each other. The tubercle on the anterior surface of the eye is more prominent and acute; the eyes themselves are of greater size. The spine of the antennal scale extends away beyond the blade, much more so than the allied species. The pleon is relatively shorter than in *N. lar* and *N. dentata*; the median carina in the female is higher; the carinæ of the sixth segment end in a

small spine or tooth, as in *N. dentata*. The median carina of the male is higher than in the female, but there is less difference than in the above

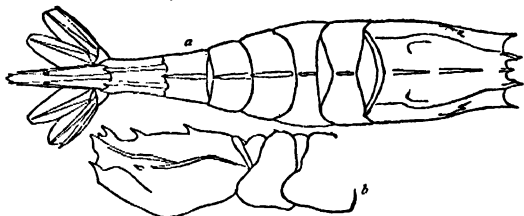


FIG. 78. *Nectocrangon ovifer*. ♀ (nat. size). Station 3225. a. Dorsal view of carapace and abdomen. b. Side view of carapace and part of abdomen.

species. The hands are from three and a half to four times as long as their width across the palm, like those of *N. lar*. The eggs are larger than those of *N. lar* or *N. dentata*, having a diameter of about 1.8 mm. as against 1.2 in *N. dentata*.



FIG. 79. *Nectocrangon ovifer*. ♂ (X 18). Station 3225. a. Antenna. b. Chela.

Dimensions.—Female bearing eggs, length 60 mm., length of carapace 17.4 mm. Male, length 35.5 mm., length of carapace 9 mm.

Type locality.—Off the Trinity Islands, Alaska, 159 fathoms (*Albatross* station 2853).

Distribution.—Bering Sea, from 57° 39' 00" north latitude to Aleutian Islands and Alaska Peninsula as far as Kadiak, 56–368 fathoms, at 26 stations of the *Albatross*.

The three foregoing species are not to be separated at a glance, but the examination of hundreds of specimens of each shows that the differences here mentioned are constant.

NECTOCRANGON CALIFORNIENSIS Rathbun.

Nectocrangon californiensis RATHBUN, Proc. U. S. Nat. Mus., xxiv, 892, 1902.

Allied to *N. ovifer*. Represented only by small specimens which differ from specimens of *N. ovifer* of equal size. The anterior margin outside the orbital fissure is furnished with two spines close together, instead of one in the allied species.

The eyes are smaller than in *N. ovifer*, but have a prominent tubercle. The spine of the antennal scale extends only slightly beyond the blade. The hands are from three and a half to four times as long as wide; they have the spine situated nearer the proximal end

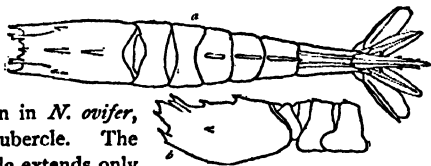


FIG. 80. *Nectocrangon californiensis* (X 2). Station 3664. a. Dorsal view of carapace and abdomen. b. Side view.

than in *N. ovifer*, and the anterior margin (against which the dactylus fits) in consequence more longitudinal.

The first and second abdominal segments are without a carina; that on the third and fourth segments is rather feebly developed.

Dimensions.—Male, length 31 mm., length of carapace 8.6 mm.

Type locality.—Off Santa Catalina Island, California, 80 fathoms (*Albatross* station 3664).

Additional localities.—Off Santa Cruz Island, California, 155 fathoms, station 2949; south of Santa Catalina Island, 59 fathoms, station 3665 (specimen 39 mm. long).



FIG. 81. *Nectocrangon californiensis* (× 34). 3664. a. Acicle. b. Chela.

NECTOCRANGON ALASKENSIS Kingsley.

Nectocrangon alaskensis KINGSLEY, Bull. Essex Inst., XIV, 128, 1882.

Female.—Three equidistant spines on the median carina, and between these and the spine on the anterior margin there is usually a small spine. Lateral carina scarcely traceable. Antennal spine large. Spine of an-

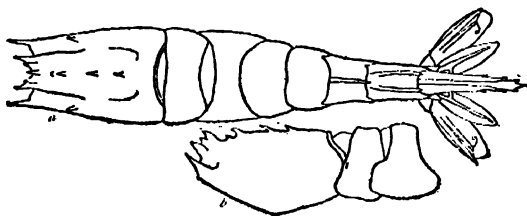


FIG. 82. *Nectocrangon alaskensis*. ♀ (× 14). a. Dorsal view of carapace and abdomen. Station 2869. b. Side view. Station 2868.

tennal scale overreaching the blade. Hands of first pair of feet about four and a half times as long as wide, anterior margin longitudinally oblique. Sternal crest in the male armed with slender spines. First to fourth abdominal segments smoothly rounded; fifth having a sharp median crest ending posteriorly in a sharp spine, and a spine at the postero-inferior angles; sixth segment with two sharp crests terminating in small spines; the posterior margin has also a large supero-lateral spine, and a small infero-lateral spine.



FIG. 83. *Nectocrangon alaskensis*. ♀ (× 18). Station 2869. a. Acicle. b. Chela.

Male.—Smaller than the female. The spine at the antero-lateral angle is much longer than in the female, considerably overlapping the antennal scale. The scale is a little longer also. The

first to fourth segments of the abdomen have a median carina, usually sharp and high on the first three segments but not extending the full length of each segment.

Dimensions.—Female, length 66.5 mm., length of carapace 17.7 mm. Male, length 44.3 mm., length of carapace 11.2 mm.

Distribution.—From Bering Sea, near the Pribilof Islands, to Oregon, including Puget Sound, 24–121 fathoms. Taken by the *Albatross* at 38 stations.

Also collected by W. H. Dall at the following localities:

Iliuliuk, Unalaska, 3–6 fathoms; Captains Bay, Unalaska; Shahafka Cove, Kadiak.

NECTOCRANGON CRASSA Rathbun.

Nectocrangon crassa RATHBUN, The Fur Seals and Fur-Seal Islands of the North Pacific Ocean, Pt. III, 556, 1899.

Female.—Body stout.

Carapace more than one third the length of the abdomen; three strong equidistant spines on the median carina; between the first of these spines and the spine on the anterior margin there is a small tooth or spinule. Lateral carina well marked. Antennal spine not reaching the antennal scale. Spine of scale extending well beyond the blade.

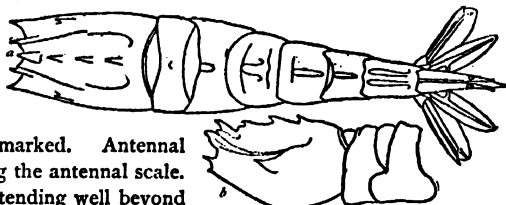


FIG. 84. *Nectocrangon crassa*. ♀ (X11). Station 3245. a. Dorsal view of carapace and abdomen. b. Side view.

The hand of the first pair of feet is a little more than three times as long as wide; its anterior margin is longitudinally oblique; the spine is short and stout. Sternal crest of male armed with spines.

Abdomen slightly sculptured; first to fifth segments furnished with a blunt median carina; sixth and seventh segments having two carinae, those of the sixth segment converging and disappearing toward the posterior margin; this margin has a large lobe at the supero-lateral angles; the fourth, fifth, and sixth segments have a small tooth or spine at infero-posterior angles.



FIG. 85. *Nectocrangon crassa*. ♀ (X11). Station 3245. a. Antenna. b. Chela.

Male.—Smaller and more slender than female; abdominal carinae stronger.

Dimensions.—Female, length 48.5 mm., length of carapace 13 mm.

Distribution.—Bering Sea and Aleutian Islands, 11½ to 55 fathoms at 24 stations of the *Albatross*; Aleutian Islands to Sitka, 5 to 28 fathoms, at 10 localities (W. H. Dall); Alaska (U. S. R. S. *Corwin*), one specimen; Bering Island, some specimens taken from the stomach of *Gadus macrocephalus* (N. Grebnitzky).

NECTOCRANGON LEVIOR Rathbun.

Nectocrangon levior RATHBUN, Proc. U. S. Nat. Mus., XXIV, 892, 1902.

This species is very close to *N. crassa*. The first four abdominal segments are non-carinate, except for a short feeble elevation on the first; the first segment has a median tubercle; and the pleura of all the segments have shallow depressions suggestive of the sculpturing of *N. crassa*; the carinae of the fifth and sixth segments are less clearly marked than in *N. crassa*.

Dimensions.—Female, length 47.7 mm., length of carapace 13.1 mm.

Distribution.—This species is more rare than *N. crassa* and extends farther south. One female was taken in Admiralty Inlet, Puget Sound, 40 fathoms, station 2865, by the *Albatross*, and serves as the type. Another female was dredged off Cape Beale, Vancouver Island, in 34 fathoms, station 2880. One female from Portlock Bank, 68 fathoms, station 2856. Six females and one male come from Davidson Bank, south of the Aleutian Islands, 42 fathoms, station 2845. One or two specimens were taken by Dr. Dall at each of the following localities: Port Levashef, Unalaska, 20–30 fathoms. Semidi Islands, 12–28 fathoms. West side Middleton Island, 10–12 fathoms.

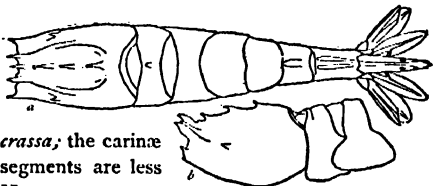


FIG. 86. *Nectocrangon levior*. ♀ (X 2½). Station 2865. a. Dorsal view of carapace and abdomen. b. Side view.



FIG. 87. *Nectocrangon levior*. ♀ (X 1½). Station 2865. a. Acicle. b. Chela.

Genus *Paracrangon* Dana.

PARACRANGON ECHINATA Dana.

Paracrangon echinatus DANA, Proc. Acad. Nat. Sci. Phila., 1852, p. 20; Crust. U. S. Expl. Exped., 1, p. 538, 1852, pl. XXXIII, fig. 6, 1855. —HOLMES, Occas. Papers Calif. Acad. Sci., VII, 176, pl. 11, figs. 36 and 37, 1900, and synonymy.

Carapace furnished with a median carina unequally four-toothed. Rostrum long, obliquely erect; posterior margin with one tooth near the

middle, anterior margin with one tooth near the tip, and at base a long curved spine. Sides of carapace carinated in such a way as to form irregular quadrangular spaces, with spines at most of the angles; four or five of these spines form an irregular lateral carina, the anterior spine being much the longest, about four fifths the length of the rostrum. On the anterior margin of the carapace there is a spine at the outer angle of the orbit and another at the antero-lateral angle. The antennular peduncle is two thirds as long as the carapace; the second segment is more than twice as long as the third; the basal scale is very short and ovate; the outer flagellum is very much stouter and twice as long as the inner. The antennal scale is as long as the antennular peduncle but not so long as the antennal peduncle; the laminar portion projects considerably beyond the short, stout outer spine; the outer margin is slightly concave. The flagellum when bent back reaches the sixth abdominal segment. The maxillipeds reach beyond the antennal peduncle by half the length of the dactylus. The first pair of feet are about as long as the maxillipeds; the upper margin of the merus terminates distally in a tooth; the hands are narrow-elongate, about four times as long as wide; the digital spine is very long and slender and directed in an obliquely longitudinal direction; the anterior margin is more longitudinal than transverse. The third pair of feet (it is to be borne in mind that the second pair are absent) are very slender and barely reach to the end of the first pair; the fourth and fifth pairs are of about equal length, and stretch a little beyond the first pair.

The abdomen behind the second segment is carinate, the carina of the third segment being especially high; on the sixth and seventh segments it is medially sulcate. The first to fifth segments are deeply sculptured with transverse grooves, and their inferior margins are pointed, those of the fourth and fifth segments being sharply so. In the male the pleura are much more spiniform than in the female. The fourth segment has on each side of its posterior margin a blunt tooth; the fifth segment has a corresponding spine. The sixth segment has on each side two lateral and one posterior spine. The telson is armed with two small spines at the proximal end, and three pairs of lateral spinules on the terminal half. The outer uropod is shorter than the inner, is obliquely truncated at the end, and has a broad blunt tooth at the postero-lateral angle. The median ventral line of the pleon is armed with very long spines.

Dimensions.—Female with eggs, length of body measured from tip of spine at anterior base of rostrum 47.4 mm., length of carapace from same point 16 mm., length of carapace from posterior line of orbit 12 mm.

Distribution.—Port Etches, Alaska, to Puget Sound; ¹ Japan. Port Etches, Alaska, 12 to 18 fathoms (W. H. Dall), one specimen. Dredged by the *Albatross* in the Straits of Fuca in 40 to 48 fathoms at stations 2864, 3464, and 3465, and in Puget Sound in 40 fathoms, station 2865. Puget Sound (T. Kincaid). Puget Sound, Oregon, dredged (Dana). McLaughlin Bay, Campbell Island, 10–30 fathoms (Whiteaves). Vancouver Island (Smith). North of Japan, lat. $44^{\circ} 27' 00''$ N., long. $141^{\circ} 22' 00''$ E. (Miers).

Family *SERGESTIDÆ*.

Genus *Sergestes* Milne Edwards.

KEY TO THE SPECIES OF SERGESTES.

- A. First joint of antennular peduncle only slightly longer than third joint. Rostrum spiniform. Cornea larger than eye-stalk. . . *atlanticus*.
 A'. First joint of antennular peduncle considerably longer than third joint. Rostrum lobiform. Cornea no larger than eye-stalk, *sp. indet.*

SERGESTES ATLANTICUS Milne Edwards.

Sergestes atlanticus MILNE EDWARDS, Ann. Sci. Nat., XIX, 349, 1830; Hist. Nat. Crust., II, 428, 1837.—HANSEN, Proc. Zool. Soc. London, 1896, 949 and 951.

Sergestes fristii KRÖYER, Kongel. Danske Vidensk. Selsk. Skr., 5 Række, naturvidensk. mathem. Afd., IV, 235, pl. 1, fig. 1, 1859.

Sergestes pacificus STIMPSON, Proc. Acad. Nat. Sci. Phila., XII, 45 [114], 1860.

Distribution.—North and South Atlantic, North and South Pacific, and Indian Oceans:

North Atlantic: Northward to 42° (Hansen); various localities, from off Chesapeake Bay, 2425 fathoms, southward (Bate); Sargasso Sea, 500 to 700 meters (Ortmann).

South Atlantic: Off Monte Video, 600 fathoms (Bate); South Equatorial Stream (Ortmann).

North Pacific: Lat. $27\frac{1}{2}^{\circ}$ N., long. 138° E. (Stimpson); China Sea (Hansen); off Japan, 345 fathoms (Bate). Specimens were taken by the *Albatross*, as follows:

Off Destruction Island, Washington, 516 fathoms, station 3343.

Off Sea Lion Rock, Washington, 477–636 fathoms, stations 3070, 3072, 3073.

¹ The locality "California" attributed to Miers is probably an error, as he apparently considered Puget Sound as on the Californian coast, and the specimens in the British Museum which were received from the Smithsonian Institution were undoubtedly from Puget Sound. (See Proc. Zool. Soc. London, 1879, 52.)

Off Cascade Head, Oregon, 345 fathoms, station 3347.

Off Point Arena, California, 239 fathoms, station 3349.

Off Farallone Islands, 552 fathoms, station 3162.

South of Farallone Islands, 217 fathoms, station 3105.

Off Monterey Bay, 418 fathoms, station 3127.

Off San Luis Obispo Bay, 252 fathoms, station 3195.

Off Point Conception, 233 and 284 fathoms, stations 2891, 2892.

Santa Barbara Channel, 322 and 314 fathoms, stations 2903, 2904.

Gulf of California, northwest of Tiburon Island, 145 fathoms, station 3015.

South Pacific: Lat. 15° S., long. $109^{\circ} 20'$ E. (Hansen); off Fijis, 315 fathoms (Bate); south of Australia, 2150 fathoms (Bate).

Indian Ocean (Hansen).

Size.—The largest specimen examined (station 3195) measures 52 mm.; the average length is about 40 mm. There is no indication on any of the labels that the specimens came from the surface or from any intermediate depth.

Common at surface, where no specimen exceeds 30 mm. (Hansen). At 600, 2150, and 345 fathoms, specimens measure 38, 43, and 50 mm. respectively (Bate).

SERGESTES sp. indet.

A single mutilated female *Sergestes*, without maxillipeds or trunk-legs, was dredged by the *Albatross* in 417 fathoms off San Diego, California, station 2928. It resembles *S. mollis* Smith. Body stout; length about 38 mm. The rostrum and anterior outline are as in that species. There is a minute hepatic spine. A strong ridge runs from the anterior margin at the outer edge of the eye-stalk backward to the posterior margin; the front part of the ridge is higher up than in *S. mollis*; at its middle the ridge gives off a weaker branch directed obliquely downward and backward, and then backward to the posterior margin. Gastro-cardiac groove deep; cervical groove present. Eyes a little shorter than in *S. mollis*, reaching $\frac{3}{4}$ the length of the first antennular segment; cornea brown. Antennular peduncle rather stout, first joint the longest, $1\frac{2}{3}$ times the second joint; second and third subequal; notch in outer side of first segment very slight. Antennal scales broken off. Abdomen as in *S. mollis*. Telson broken off. No hairs visible on outer margin of outer uropod.

Family PENÆIDÆ.

Genus *Penæus* Fabricius.

PENÆUS BREVIROSTRIS Kingsley.

Penæus brevirostris KINGSLEY, Proc. Acad. Nat. Sci. Phila., 1878, 98.

Penæus californiensis HOLMES, Occas. Papers Calif. Acad. Sci., VII, 218, pl. IV, figs. 64–69, 1900.

Penæus brevirostris RATHBUN, Proc. Wash. Acad. Sci., IV, 287, 1902.

Distribution.—San Francisco Bay, California, to Panama; Galapagos Islands. To a depth of $51\frac{1}{2}$ fathoms.

Taken by the *Albatross* at the following localities: Magdalena Bay, Lower California; off Santa Margarita Island, Lower California, 47 fathoms, station 3039; Gulf of California, $9\frac{1}{2}$ –33 fathoms, stations 2823, 3013, 3022, 3025, 3031, 3037; also at Guaymas; Concepcion Bay, mouth of Rio Mulege; Algodones Lagoon; and La Paz Harbor. Panama; Panama Bay, $29\frac{1}{2}$ – $51\frac{1}{2}$ fathoms, stations 2795, 2799, 2804, 2805.

Genus *Benthescymus* Bate.

BENTHESICYMUS TANNERI Faxon.

Benthescymus tanneri FAXON, Bull. Mus. Comp. Zool., XXIV, 215, 1893; Mem. Mus. Comp. Zool., XVIII, 205, pl. H, 1895.

Distribution.—From off San Diego, California, to Ecuador; Galapagos Islands. 331–1322 fathoms.

The *Albatross* has collected this species at the following localities, besides those cited by Faxon:

Off San Diego, 822 and 623 fathoms, stations 2923, 2929.

Gulf of California, 857 and 1005 fathoms, stations 3009, 3010.

Off Cape San Francisco, Ecuador, 401 and 741 fathoms, stations 2792, 2793.

Galapagos Islands, 634 and 392 fathoms, stations 2808, 2818.

Genus *Gennadas* Bate.

GENNADAS BOREALIS Rathbun.

Gennadas borealis RATHBUN, Proc. U. S. Nat. Mus., XXIV, 887, 1902.

Submembranous, glabrous. Rostrum reaching at least half-way along the eye-stalk, sometimes to the cornea, armed with a single tooth, carina very distinct nearly to the posterior border of the carapace, but sharpest in front of the cervical groove. There is a sharp marginal spine at the angle of the anterolateral sinus.

Eyes light brown, globular, having a speck of black



FIG. 88. *Gennadas borealis*. *a*. Station 3783. *a*. Side view of carapace ($\times 2$). *b*. Thelycum ($\times 5$).

pigment near their base on the outer margin of the stalk; tubercle large and acute. Antennular flagella broken, the upper one thick at base. The antennal scale extends beyond the antennular peduncle by about the length of the last segment of the peduncle. Antennal flagellum as long

as body. The dactylus of the external maxillipeds is subspatulate, fully twice as long as broad. The chelæ of the first pair of feet are narrow and elongate, as in the succeeding pairs.

Exopodites of first abdominal appendages not so long as the carapace; between the bases of these appendages is a sharp spine, equally developed in both sexes. The thelycum consists of a horizontal convex subtriangular plate or tubercle, placed between the third pair of legs, followed by two transverse plates between the fourth and fifth pairs. The



FIG. 89. *Gennadas borealis*.
8. Station 3783. a. Petasma
($\times 64$). b. Foot of first pair
($\times 4$).

anterior of these two plates is subquadrilateral, narrowest in front; the posterior one is somewhat fan-shaped, narrow behind, its anterior margin rounding and with a blunt median point. The andricum or petasma consists of a pair of small leaves not in contact, each of which is attached at its proximal end. At extremities of distal margin are two lobes or teeth, the outer one of which is curved. The inner portion is partially folded to form an irregular longitudinal plait. The sixth abdominal somite is carinate; it is more than twice as long as the fifth. The telson has a small lateral spine at its posterior fourth, two spines at the tip. The caudal swimmerets are broken in all our specimens.

Dimensions.—Male, length of carapace and rostrum 13.6 mm., length of abdomen on middle line 29 mm. Female, length of carapace and rostrum 18 mm., length of abdomen on middle line 37 mm.

Distribution.—North of Rat Islands, Aleutians, 850 fathoms (*Albatross* station 3784), 2 ♂; off Copper Island, Kamchatka, 1567 fathoms, station 3783 (type locality), 1 ♂, 2 ♀.

Very near *G. parvus* Bate, but differs in the longer rostrum, the presence of a lateral spine on the telson, the greater length of the antennal scale, the elongated chelæ of the first pair of feet, and the different form of the thelycum and andricum.

A specimen of *Gennadas* was dredged by the *Albatross* off San Diego in 417 fathoms, station 2928, but it is so badly mutilated that it is impossible to say whether it is the same species as the above or not.

Family PALINURIDÆ.

Genus Panulirus White.

PANULIRUS INTERRUPTUS (Randall).

Distribution.—Southern California to Mexico. In the National Museum are specimens ranging from Santa Barbara, California, to Rosalia Bay, Lower California.

Family AXIIDÆ.

Genus *Axius* Leach.*AXIUS SPINULICAUDA* Rathbun.*Axius spinulicauda* RATHBUN, Proc. U. S. Nat. Mus., xxiv, 886, 1902.

Carapace (rostrum included) measured in the middle line, as long as the first 5 abdominal somites, cervical groove deep, branchial groove indistinct. Gastric region traversed by 5 carinæ, all of which fade out before reaching the cervical groove; the median extends along the basal third of the rostrum and is armed with 4 spines just behind the line of

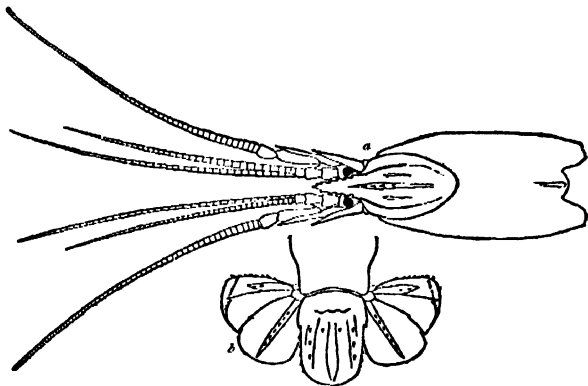


FIG. 90. *Axius spinulicauda*. ♀ (×2). Station 3172. a. Carapace and antennae. b. Swimming-fan.

the orbits; the posterior of these spines is broken off in the unique type; the outer carinæ are a continuation of the side margins of the rostrum; they, as well as the shorter intermediate carinæ, are unarmed. The surface is covered with rather distant scabrous granules. In front of the narrow median posterior lobe, the surface is compressed or pinched to form a short smooth ridge. The rostrum reaches the middle of the second joint of the antennular peduncle, is slightly deflexed, longitudinally-channeled, sharp-pointed, armed with 5 spines on one side and 6 on the other.

Eyes black, of the same diameter as the stalk, not reaching the middle of the basal antennular segment. The basal expansion of this segment has convex side margins, an antero-external spine, and reaches just beyond the middle of the segment; the second segment is a little longer than the third, and the two together are shorter than the first. The entire pe-

duncle extends to the middle of the penultimate joint of the antennal peduncle. The outer flagellum is almost as long as the carapace and rostrum; the inner is a fifth longer than the outer. The scaphocerite projects as far as the middle of the second antennular segment, while the stylocerite projects to the end of the penultimate joint of the antennal peduncle; this joint is nearly 3 times as long as the last joint. The flagellum is broken off, but the part remaining reaches beyond the antennular flagella.

The outer maxillipeds reach the end of the antennal peduncle. The first pair of chelipeds are missing. The second pair are rather narrow; the merus has 3 spines on its lower margin; the carpus is half as long as the merus and three fourths as long as the propodus; palm and fingers subequal; lower margin of merus, carpus, and propodus fringed with long hair. The third to fifth pairs of feet are slender; the lower margin of the distal half of the propodi is fringed with long hair; the dactyli are slender, those of the third and fourth pairs contained 3 times in their propodi, those of the fifth pair contained 4 times in their propodi.

The abdomen is smooth above, but the pleura are sculptured and pubescent; the telson is elongate, subquadrilateral, lateral margins spinulose, dorsal surface with a few spines; caudal swimmerets about as long and as broad as the telson; inner one with two outer marginal spines, carina spinulose; outer branch with serrate outer margin, outer carina with 1 or 2 spinules, obliquely transverse suture bordered by slender spinules.

Dimensions.—In the unique type, a female, the length of the carapace and rostrum along the median line is 19.6 mm., length of rostrum 3.5 mm., of abdomen 31.5 mm.

Type locality.—Off Bodega Head, California, 62 fathoms (*Albatross* station 3172).

From the other species on the west coast of North America, viz., *Axiu cristagalli* Faxon and *A. acutifrons* (Bate), both of which occur off Panama, *A. spinulicauda* is readily distinguished by the five gastric carinae and the black eyes.

Genus *Calastacus* Faxon.

KEY TO THE SPECIES OF CALASTACUS.

- A. Carapace granulate; no spines behind those at base of rostrum,
investigatoris.
- A'. Carapace not granulate; 5 rows of spines behind the rostrum,
quinqueseriatus.

CALASTACUS INVESTIGATORIS Anderson.

Calastacus investigatoris ANDERSON, Jour. Asiatic Soc. Bengal, LXV, Pt. II, 97, 1896. Illustrations of the Zoology of the Investigator, Crustacea, Pt. IV, pl. XXV, fig. 1, 1896.—ALCOCK, Descriptive Catal. Indian Deep-Sea Crust. Dec. Macr. and Anom. in Indian Mus., 191, 1901.

Distribution.—Taken by the *Albatross*, south of Sannak Islands, Alaska, 483 fathoms, station 3210, 1 ♀; off Cascade Head, Oregon, 345 fathoms, station 3347, 1 ♀; off San Diego, California, 417 fathoms, station 2928, 2 ♀.

Type locality.—Arabian Sea, off the coast of Sind, 947 fathoms (*Investigator*).

The antennal spines of one Californian specimen agree with Alcock's description, while in the Alaskan and Oregonian examples the scaphocerite and stylocerite are about equally produced; in the second Californian specimen the stylocerite is broken off. There is also variability in the spination of the upper margin of the merus of the large chelipeds; in one individual (from California) the whole margin is armed with spines which are proximally reduced in size; in the other three individuals examined only the distal half of the margin is armed, as in the types.

CALASTACUS QUINQUESERIATUS Rathbun.

Calastacus quinqueseriatus RATHBUN, Proc. U. S. Nat. Mus., XXIV, 887, 1902.

Carapace (rostrum included) measured in the middle line, as long as the first 5 abdominal somites; its surface is pitted, especially on the infero-lateral portions, and a few feeble setæ spring from the pits; cervical groove deep, branchial grooves indistinct. The rostrum reaches to the end of the second joint of the antennular peduncle and is tipped with a spine; its lateral margins are armed with 3 to 7 spines, and the prolongations of these margins extend two thirds the length of the gastric region, are armed with 5 or 6 spines, and form a horseshoe on the carapace which is open behind and outlined in front by a groove a little posterior to the orbit. The median carina extends from the middle of the rostrum to the rear of the horseshoe and is from 2 to 6 (usually 3) spined at its middle. Between the median carina and the sides of the horseshoe is another row of 3 to 5 spines. The eyes are colorless and form a globular tip to the short eye-stalk.

Expanded basal portion of the first joint of the antennular peduncle narrow-oval, bearing 1 or 2 marginal spinules near the tip. Stylocerite of antennal peduncle reaching to distal third of the penultimate joint; scaphocerite not reaching middle of the stylocerite. The external

maxillipeds reach to the end of the antennal peduncle. The chelipeds are unequal, the longer one in the male nearly as long as the body; setose; its inner surface and also the outer surface of carpus and manus covered with sharp granules or short spines; upper margin spinose, also lower inner margin of merus; lower outer margin of merus outlined with

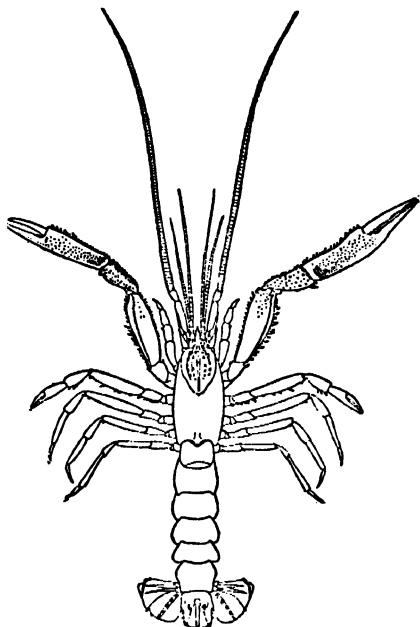


FIG. 97. *Calastacus quinqueseriatus*. ♂ (X about 8).
Station 3196.

very short blunt spines and a single longer distal spine; lower margins of propodus armed with dentiform granules. Margins of propodus sub-parallel. Fingers shorter than palm in adult males, just as long as palm in smaller males and in females; usually slightly gaping at base; occludent edges finely and irregularly dentate. The stouter cheliped may be longer or shorter than the slenderer one. In the female the chelipeds are two thirds as long as the body. The second pair of feet are a little stouter and shorter than the last three pairs; the first four joints have a few spines on lower margin; the carpus a few spines toward the distal end; margins long-setose. Meral

joints of third and fourth pairs of legs with an infero-distal spine; last three pairs more or less setose, especially so on the dactylus and distal end of the propodus. Abdomen almost smooth; there are a few setae on the sides and on the swimming-fan. The pleura behind the first, which is subacute and armed with a spine, are rounded and decrease in length from the second to the fifth, the anterior margin of the third, fourth, and fifth, and lower margin of sixth, being armed with a small spine. Telson subquadrangular, broadly rounded behind, a median groove, a few lateral and one median marginal spine, 2 larger dorsal spines. Inner branch of caudal swim-

meret with a longitudinal 4- to 6-spined carina and a postero-lateral spine. Outer branch with a transverse row of small spines near the posterior end, and a few lateral marginal spinules also near the posterior end.

Dimensions.—Male, length of carapace and rostrum, measured in the middle line, 28 mm., length of abdomen 41 mm.

Distribution.—Southern California, 160–388 fathoms, at the following stations of the *Albatross*:

Off Point Sur, 298 fathoms, station 3187.

Off San Simeon Bay, 160 fathoms, station 3193.

Off San Luis Obispo Bay, 252, 200 fathoms, stations 3195, 3196 (type locality).

Off Point Conception, 233–284 fathoms, stations 2891, 2892, 3198.

Santa Barbara Channel, 205–280 fathoms, stations 2909, 3199–3201.

Off Anacapa Island, 388 fathoms, station 2979.

Allied to *C. felix* Alcock and Anderson, from which it is easily distinguished by the more numerous spines of the carapace, the longer penultimate segment of the antennular peduncle, the squarer telson, etc.

Family *CALLIANASSIDÆ*.

Genus *Upogebia* Leach.

UPOGEBIA PUGETTENSIS (Dana).

Harriman Expedition.—Cape Fox, Alaska (W. R. Coe).

Distribution.—From southeastern Alaska to San Quentin Bay, Lower California (Lockington).

Localities worthy of note represented in the National Museum are:

Southeastern Alaska: Kasaan Bay, Prince of Wales Island; Union Bay, Cleveland Peninsula; Thorn Arm.

British Columbia: Nanaimo; Comox; Departure Bay; Sucia Island; Otter Bay, Pender Island.

California: Mouth of Tia Juana River, San Diego County.

Genus *Callianassa* Leach.

KEY TO THE SPECIES OF CALLIANASSA.

A. Front with median tooth either obscure or not prominent. Eyes pigmented.

B. Eye-stalks with acute and divergent extremities.

C. Median prominence of front rounded; cornea at middle of eye-stalk; large cheliped of male very broad, the carpus very little longer than broad, but considerably longer than palm,
californiensis.

C'. Median prominence of front subacute; cornea just behind

middle of eye-stalk; large cheliped of male elongate, the carpus twice, or nearly twice, as long as broad . . . *longimana*.

B'. Eye-stalks oblong, their inner extremities tuberculiform, and not diverging; cornea in front of middle of eye-stalk; carpus of large cheliped of male very little longer than broad, and very little longer, sometimes even shorter, than palm *affinis*.

A'. Front with a sharp and prominent median tooth.

B. Eyes not pigmented, oblong; large cheliped of male with carpus much shorter than wide *goniophthalma*.

B'. Eyes pigmented, tips acute and divergent, cornea behind the middle of the stalk; large cheliped of male with carpus a little longer than wide *gigas*.

CALLIANASSA CALIFORNIENSIS Dana.

Distribution.—From Mutiny Bay, Alaska (Lockington), to mouth of Tia Juana River, San Diego County, California (Dr. E. A. Mearns, U. S. A.).

Besides published localities, there are in the National Museum specimens from Departure Bay, Vancouver Island, British Columbia, and San Diego, California.

CALLIANASSA LONGIMANA Stimpson.

Distribution.—From Vancouver Island, British Columbia (Bate), to San Quentin Bay, Lower California (Lockington).

CALLIANASSA GIGAS Dana.

Distribution.—Puget Sound (Dana, Calman). Gulf of the Farallones, California, 21 fathoms (*Albatross* station 3150), one fragmentary specimen showing the large cheliped and portion of abdomen.

CALLIANASSA AFFINIS Holmes.

Distribution.—From Catalina Harbor to San Diego, California.

CALLIANASSA GONIOPHTHALMA Rathbun.

Plate VIII.

Callianassa goniophthalma RATHBUN, Proc. U. S. Nat. Mus., XXIV, 886, 1902.

Carapace contained in the abdomen two and a third times. Rostrum triangular, acuminate, reaching barely one third the length of eyes. Lateral projections of the front shallow blunt teeth. Behind and parallel to the front there is a sulcus which is continued back, defining the raised area of the gastric region. No median carina, but a slight, blunt elevation near the posterior margin, corresponding to the strong tooth of *C. cacigena*.

Eyes reaching nearly to end of first antennular segment, oblong, more than twice as long as wide; sides subparallel; antero-external angle rounded; antero-internal angle produced in a tuberculiform tooth, these teeth being slightly divergent from each other; eyes without pigment. First segment of antennular peduncle longest; second segment stouter, and a little shorter, than the third; flagella subequal and less than twice the length of peduncle. The antennal peduncle overreaches the antennular by the length of the last and one third of the preceding segment; the penultimate segment is twice as long as the antepenultimate and one and a half times as long as the ultimate; the flagellum is nearly as long as the body. The ischium and merus of the outer maxillipeds, while wider than the succeeding joints, are not very broad; the ischium has a lobiform opercular dilatation on its inner or lower margin; dactylus almost circular.

The chelipeds are very unequal; the larger one is equal to the carapace and first four abdominal somites combined; the ischium has a few minute spinules at the proximal end of its lower edge; the merus may have a small spine at the proximal end of its lower margin, or it may (as in the largest specimen) be devoid of armature; the carpus is nearly twice as deep as it is long and one half as long as the palm; its lower angle is rounded; the palm is a little longer than high, and subequal in length to the dactylus; its distal lower quarter has a few tubercles irregularly disposed, from which proceed bunches of hair. The lower margin of the ischium, merus, and carpus, and both upper and lower margins of the manus are carinated. The dactylus is longer than the pollex; the upper surface is very broad and has a rounded carina on the inside and the outside; the outer one is tuberculate near the base of the finger; the outer margin of the cutting surface has a broad tuberculated tooth near the palm, and a lobe near the tip; the inner margin of the cutting surface is tuberculate along its distal half; the pollex has a stout tooth on the upper edge. The fingers gape widely in the male, not at all in the female, and are beset with bunches of long hair.

The smaller cheliped is one third as wide as the larger and reaches only to the distal third of the palm of the larger. The ischium and merus are similar to those of the larger cheliped; the carpus is longer than high, lower angle subacute. The palm is a little shorter than the carpus, longer than wide. Dactylus slender, nearly twice as long as the palm and longer than the pollex, which is armed with a single sharp tooth at its proximal third; the fingers do not gape, as they overlap far from the extremities.

The second, third, and fourth pairs of legs are stout and compressed, and increase slightly in length in the order named; the fifth pair is as

long as the third. Those of the second pair are a little longer than the carapace, and end in a short, broad compressed hand, the edges and outer surface of which are setose, as are also the lower border of the merus and the upper and distal borders of the carpus. The dactyli of the remaining pairs are almost hidden in setæ.

The first of the abdominal somites is the shortest, and is one half the length of the second, which is the longest. The lateral margins of the first are rounded and upturned. The second is half as long as the carapace; its angles are rounded, the anterior pair being carinated; the third and fourth somites have rounded margins, the posterior angles being setose; the fifth somite has dentiform posterior angles; the sixth has a lateral spine in front of the middle, pointing down and back; this somite is a little longer than wide, exclusive of the spines. The telson is nearly as long as the sixth somite; its sides are subparallel, notched at the anterior third; posterior angles rounded; the caudal swimmerets are broad and rounded, the outer much the larger. The first abdominal appendage in the ♀ is slender and forked, the outer branch filiform, the inner very short, truncate, and fringed with long hair. The second to fifth pairs are very broad, foliaceous; in the second, the outer branch is very much larger than the inner; in the third, fourth, and fifth the two branches are subequal; in each case the inner edge of the endopodite bears near its middle a small styliform appendage. In the ♂ the terminal joint of the first abdominal appendage is somewhat scythe-shaped, with a lobe at the inner base of the scythe. The third to fifth pairs are similar to those of the ♀; the second pair is much smaller, branches subequal, inner styliform appendage larger and fringed with hair toward the extremity.

Dimensions.—Male, station 3198, length of carapace 30.5 mm., of abdomen 67.5 mm.; female, station 3077, length of carapace 22.2 mm., of abdomen 52 mm.

Distribution.—Clarence Strait, Alaska, 322 fathoms, station 3077, 4 ♂, 2 ♀; off Point Conception, California, 278 fathoms, station 3198 (type locality), 1 ♂ (*Albatross*).

Closely allied to *C. cæcigena* Alcock and Anderson, but differs in the shorter rostrum, in the absence of spines on the second to fifth somites of the abdomen, in the squarer telson. The shape of the first pair of chelipeds is the same as in *C. cæcigena*, but the carpus of the larger one is without a spine, the palm is not serrated on its lower margin, its outer surface is furnished with tubercles on the distal lower quarter, to which also the hairs are restricted; the pollex is shorter in our species and its tooth is nearer the middle.

Suborder ANOMURA.

Family PAGURIDÆ.

Genus Pagurus Fabricius.

PAGURUS ALASKENSIS (Benedict).

Pagurus alaskensis Benedict, Proc. U. S. Nat. Mus., XXIII, 456, text fig., 1901, and synonymy.

Distribution.—Bering Sea (Siberian and Alaskan coasts) to Oregon; beach to 136 fathoms.

PAGURUS ALEUTICUS (Benedict).

Pagurus aleuticus Benedict, Proc. U. S. Nat. Mus., XXIII, 460, text fig., 1901, and synonymy.

Color.—Specimens in formalin showed the spines orange-red or crimson-red, eye-stalks and antennal scales reddish.

Harriman Expedition.—Juneau, 50 fathoms.

Distribution.—From Bering Sea (latitude of Pribilof Islands) to Oregon; 8 to 238 fathoms.

PAGURUS OCHOTENSIS Brandt.

Pagurus ochotensis Benedict, Proc. U. S. Nat. Mus., XXIII, 463, text fig., 1901, and synonymy.

Distribution.—Unalaska to San Diego, California; 6 to 80 fathoms. Okhotsk Sea (Brandt). Japan (Stimpson).

PAGURUS TRIGONOCHEIRUS (Stimpson).

Distribution.—From the Arctic coast of Alaska and Siberia southward through Bering Sea to the Aleutian Islands and Kamchatka; 3 to 100 fathoms.

PAGURUS CAPILLATUS (Benedict).

Plate IV, fig. 3.

Harriman Expedition.—Sitka, 10 fathoms.

Distribution.—Arctic Ocean southward through Bering Straits to Kamchatka and California (lat. $36^{\circ} 55' N.$); 3 to 240 fathoms.

PAGURUS BRANDTI (Benedict).

Plate IV, fig. 4.

Distribution.—Bering Sea (latitude of Pribilof Islands) southward to Oregon; 9 to 121 fathoms.

PAGURUS DALLI (Benedict).

Plate IV, fig. 1.

Color.—In formalin, legs banded with yellowish-red, the red coming at the articulations, the light band in the middle of the segments.

Harriman Expedition.—Dutch Harbor, Unalaska (W. R. Coe); Kodiak; Berg Bay, Glacier Bay, 20 fathoms; Juneau, 20 fathoms.

Distribution.—Bering Sea (latitude of Nunivak) to Oregon; low water to 151 fathoms.

PAGURUS RATHBUNI (Benedict).

Plate IV, fig. 2.

Distribution.—Bering Sea; east coast to Kamchatka; Okhotsk Sea, near Robben Island; 10 to 100 fathoms.

PAGURUS TANNERI (Benedict).

Plate IV, fig. 7.

Distribution.—From Iliuliuk Harbor, Unalaska, to off San Simeon Bay, California (lat. $35^{\circ} 35' N.$); 50 to 559 fathoms.

PAGURUS CONFRAGOSUS (Benedict).

Plate IV, fig. 8.

Harriman Expedition.—Juneau, 50 fathoms.

Distribution.—From Bering Sea (latitude of Pribilof Islands) to mouth of Columbia River, Oregon; 41 to 238 fathoms.

PAGURUS CORNUTUS (Benedict).

Plate V, fig. 3.

Eupagurus cornutus Benedict, Proc. U. S. Nat. Mus., xv, 12, 1892.

Distribution.—Bering Sea (lat. $55^{\circ} 38' N.$) to off Queen Charlotte Sound, British Columbia; 91 to 406 fathoms.

PAGURUS TOWNSENDI (Benedict).

Plate IV, fig. 5.

Eupagurus townsendi Benedict, Proc. U. S. Nat. Mus., xv, 13, 1892.

Distribution.—From Pribilof Islands to Unalaska and Shumagin Bank; 284 to 625 fathoms.

PAGURUS BERINGANUS (Benedict).

Plate v, fig. 5.

Eupagurus beringanus Benedict, Proc. U. S. Nat. Mus., xv, 17, 1902.*Harriman Expedition*.—Orca, Prince William Sound (W. R. Coe); Yakutat Bay (T. Kincaid); Sitka, 10 fathoms; Sitka Harbor.*Distribution*.—Bering Sea (latitude of Nunivak) southward along the Aleutian Islands and coast of Alaska to Monterey, California; 5 to 19 fathoms.

I have included *P. newcombei* (Benedict) in *P. beringanus*, as it seems to be scarcely distinct. The species varies in the sharpness of the tubercles or spines of the chelipeds.

PAGURUS UNDOSUS (Benedict).

Plate iv, fig. 6.

Eupagurus undosus Benedict, Proc. U. S. Nat. Mus., xv, 18, 1892.*Distribution*.—Bering Sea, in vicinity of Pribilof Islands; Bering Island; Kamchatka; off Robben Island, Okhotsk Sea; 10 to 35 fathoms.

PAGURUS KENNERLYI (Stimpson).

Plate v, fig. 4.

Harriman Expedition.—Victoria, British Columbia (W. R. Coe).*Distribution*.—Aleutian Islands to Washington; 9–97 fathoms.

PAGURUS SETOSUS (Benedict).

Plate v, fig. 1.

Eupagurus setosus BENEDICT, Proc. U. S. Nat. Mus., xv, 19, 1892.*Color*.—In formalin, the legs are banded with crimson-red, hair dirt color.*Harriman Expedition*.—Kadiak; Juneau, 50 fathoms. Not known previously north of Sitka.*Distribution*.—From Kadiak, Alaska, to Santa Catalina Island, California; 50–266 fathoms.

PAGURUS HIRSUTIUSCULUS (Dana).

Color.—In formalin, body and legs pinkish-red. Segments of second and third pairs of feet, white at distal ends; dactyli striped longitudinally with pinkish and white.

Harriman Expedition.—Orca; Yakutat; Juneau and Farragut Bay; Sitka, 10 fathoms; Sitka Harbor; Wrangell (T. Kincaid). Also taken by Dr. Coe at Dutch Harbor, Unalaska; Kadiak; Virgin Bay; Hot Springs; Tongass Village.

Distribution.—St. Paul Island, Pribilofs (T. Kincaid); Aleutian Islands to southern California (Holmes). Specimens are in the National Museum from as far south as Wilmington, California. East Cape, Siberia; Bering Island; Copper Island, Kamchatka; Japan (Stimpson). Low tide to 17 fathoms.

PAGURUS SAMUELIS (Stimpson).

Plate v, fig. 7.

Distribution.—Sitka, Alaska, to San Diego, California. Japan (Stimpson, Ortmann; doubted by Holmes).

PAGURUS MIDDENDORFFII Brandt.

Distribution.—Sitka (Brandt); Puget Sound (Calman); Bering Island (L. Stejneger); Castrics-Bai, Siberia (Ortmann); Okhotsk Sea (Brandt); Japan (Stimpson).

PAGURUS MINIMUS Holmes.

Distribution.—Off San Diego, California, 30 fathoms (Holmes).

PAGURUS GRANOSIMANUS (Stimpson).

Plate v, fig. 8.

Color.—Deep red, with white tubercles on the chelæ, and darker red spines on the carpus and merus of the chelipeds. Ambulatory legs red, with small white spots; dactyli with a broad white band at middle.

Harriman Expedition.—Sitka Harbor. Collected by Dr. Coe at Yakutat; Hot Springs; Sitka; Cape Fox; Tongass Village.

Distribution.—Unalaska to Ensenada, Lower California. Beach to 15 fathoms.

PAGURUS HEMPHILLII (Benedict).

Plate v, fig. 9.

Distribution.—Humboldt County to Monterey, California.

PAGURUS TENUIMANUS (Dana).

Color.—In formalin, claws yellowish-red, spines lighter. Dactyli and propodi of second and third pairs of legs spotted with darker red; carpal joints with two broad longitudinal stripes of red on upper side.

Harriman Expedition.—Kadiak; Sitka, 10 fathoms; Sitka Harbor.

Distribution.—From Aleutian Islands and Alaska Peninsula to Strait of Fuca and Puget Sound. Beach to 123 fathoms.

PAGURUS MUNITUS (Benedict).

Plate v, fig. 2.

Color.—In formalin, yellowish red. Second and third pairs of legs of the same color, with white spots which tend to coalesce.

Harriman Expedition.—Juneau, 50 fathoms (an extension of the range).

Distribution.—Bering Sea (lat. $56^{\circ} 56'$ N.) southward and eastward to Portlock Bank and Juneau, Alaska; 20 to 138 fathoms.

PAGURUS GILLI (Benedict).

Plate v, fig. 10.

Eupagurus gilli BENEDICT, Proc. U. S. Nat. Mus., xv, 20, 1892.

Color.—In formalin, orange-red. Ambulatory legs more of an orange-vermilion, as are also the bases of the antennæ. Pits on legs whitish.

Harriman Expedition.—Dutch Harbor, Unalaska; Kadiak; Orca, Prince William Sound, shore on rocks (W. R. Coe); Sitka.

Distribution.—Bering Island, Aleutian Islands; Alaska Peninsula southward to Revillagigedo Island, southeastern Alaska. Low water to 60 fathoms.

PAGURUS CALIFORNIENSIS (Benedict).

Distribution.—From Santa Catalina Island, California, to Gulf of California; 8 to 58 fathoms.

PAGURUS SPLENDESCENS Owen.

Harriman Expedition.—Juneau, 50 fathoms.

Distribution.—From Arctic coast of Alaska (at Point Barrow) westward through Bering Sea to Kamchatka and Washington. Below low water to 225 fathoms.

Genus *Paguristes* Dana.

PAGURISTES TURGIDUS (Stimpson).

Distribution.—Vancouver Island, British Columbia, to Santa Catalina Island, California.

PAGURISTES PARVUS Holmes.

Distribution.—Whites Point near San Pedro, California (Holmes).

PAGURISTES BAKERI Holmes.

Distribution.—San Diego, California (Holmes).

Genus **Holopagurus** Holmes.**HOLOPAGURUS PILOSUS** Holmes.

Distribution.—Off San Diego, California, 25 fathoms (Holmes).

Genus **Parapagurus** Smith.**PARAPAGURUS MERTENSII** (Brandt).

Plate v, fig. 6.

Distribution.—Islands of Kadiak and Atka; Nootka Sound, west coast of Vancouver Island; North California; Kamchatka (Brandt). In the National Museum are specimens from the coast of California between Lobos Rocks (lat. $36^{\circ} 26' 40''$ N.) and southeast of San Nicholas Island (lat. $33^{\circ} 00' 30''$ N.), depth 77 to 266 fathoms. The depth and locality quoted by Holmes for the specimen examined by him are probably erroneous.

PARAPAGURUS sp. indet.

Distribution.—From southeast of Chirikof Island, Alaska, to off San Diego, California; 414 to 877 fathoms.

Family **LITHIODIDÆ**.Genus **Hapalogaster** Brandt.**HAPALOGASTER CAVICAUDA** Stimpson.

Distribution.—California: Cape Mendocino to Monterey. Common under rocks at low tide.

HAPALOGASTER DENTATA (de Haan).

Lomis dentata DE HAAN, Fauna Japon., 219, pl. XLVIII, fig. 2, and pl. Q, 1849.

Hapalogaster dentatus STIMPSON, Proc. Acad. Nat. Sci. Phila., x, 232, 1858.

Distribution.—"Coloniæ rosso-americanæ" (Schalfeew); Japan (de Haan, Stimpson).

HAPALOGASTER MERTENSII Brandt.

Harriman Expedition.—Dutch Harbor, Unalaska (W. R. Coe); Fox Island (T. Kincaid); Yakutat and Sitka (W. R. Coe).

Distribution.—From Atka, Aleutians, eastward and southward to Puget Sound; to a depth of 19 fathoms.

HAPALOGASTER GREBNITZKII Schalfeew.

Harriman Expedition.—Dutch Harbor, Unalaska (W. R. Coe); Popof Island; Orca (T. Kincaid); Sitka (W. R. Coe), extending the known range.

Distribution.—From Bering Sea off the Pribilofs and Cape Newenham southward along the Aleutian Islands to Sitka, Alaska; Bering Island.

Genus *Dermaturus* Brandt.

DERMATURUS MANDTII Brandt.

Harriman Expedition.—Dutch Harbor, Unalaska; Popof Island; Sitka.

Distribution.—Pribilof Islands; Aleutian Islands and Alaska Peninsula to Sitka; Bering Island; 6 to 40 fathoms.

Genus *Ædignathus* Benedict.

ÆDIGNATHUS INERMIS (Stimpson).

Hapalogaster inermis STIMPSON, Ann. Lyc. Nat. Hist. N. Y., VII, 243, 1860.
Hapalogaster Brandti SCHALFEW, Mém. biol., XIII, 330, 1892, figs. 1 and 5b, of the Bull. Acad. imp. sci. St. Pétersbourg, XXXV, 336, 1892.

Ædignathus gilli BENEDICT, Proc. U. S. Nat. Mus., XVII, 487, 1894.

Ædignathus inermis HOLMES, Occas. Papers Calif. Acad. Sci., VII, 119, 1900, and synonymy.

Ædignathus Brandti HOLMES, *op. cit.*, 118, and synonymy.

I think there is little doubt that Schalfeew's species is identical with Stimpson's. That the number of squamæ on the carapace is variable is evidenced in the small series I have examined. Stimpson's type was smaller than any examples in the National Museum.

Distribution.—Unalaska to Pacific Grove, California.

Genus *Acantholithodes* Holmes.

ACANTHOLITHODES HISPIDUS (Stimpson).

Distribution.—Vancouver Island, British Columbia, to Monterey, California. To a depth of at least 16 fathoms.

Genus *Placetrón* Schalfeew.

PLACETRON WOSNESSENSKII Schalfeew.

Plate VI, fig. 1.

Placetrón Wosnessenskii SCHALFEW, Mém. biol., XIII, 333, 1892, fig. 6, of the Bull. Acad. imp. sci. St. Pétersbourg, XXXV, 339, 1892.

Lepeopus forcipatus BENEDICT, Proc. U. S. Nat. Mus., XVII, 488, 1894.

Distribution.—Aleutian Islands to British Columbia: Unalaska; west of Amaknak Island, 60 fathoms; northwest of Unimak Island, 43 fathoms (*Albatross* station 3262); Kadiak (Schalfeew); Parry Passage, Graham Island, British Columbia.

Genus *Phyllolithodes* Brandt.

PHYLLOLITHODES PAPILLOSUS Brandt.

Harriman Expedition.—Dutch Harbor, Unalaska. Hitherto not known west of Kadiak.

Distribution.—Unalaska to Monterey, California. To a depth of at least 16 fathoms.

PHYLLOLITHODES BICORNIS (Bate).

Distribution.—Esquimalt Harbor, British Columbia, 10 fathoms (Bate). Perhaps not distinct from *P. papillosus*.

Genus *Cryptolithodes* Brandt.

CRYPTOLITHODES TYPICUS Brandt.

Distribution.—Belkofski Bay, Alaska, to Monterey, California. Between high and low tide marks.

CRYPTOLITHODES SITCHENSIS Brandt.

Distribution.—From Sitka, Alaska, to Pacific Grove, California.

CRYPTOLITHODES BREVIFRONS Miers.

Distribution.—Vancouver Island, British Columbia. Perhaps not a valid species.

Genus *Lopholithodes* Brandt.

LOPHOLITHODES MANDTII Brandt.

Distribution.—From Sitka, Alaska, to Monterey, California.

LOPHOLITHODES FORAMINATUS (Stimpson).

Distribution.—From Victoria, British Columbia, to near San Francisco and the Farallones, California.

Genus *Rhinolithodes* Brandt.

RHINOLITHODES WOSNESSENSKII Brandt.

Rhinolithodes wosnesenskii BRANDT, Bull. Phys.-Math. Acad. Impér. Sci. St. Pétersbourg, VII, 174, 1849 (typo. error for *wosnessenskii*).
Rhinolithodes Wosnessenskii NEWCOMBE, Bull. Nat. Hist. Soc. Brit. Col., 1893, 28, pl. III.

Distribution.—Kadiak; Port Etches, 12 to 18 fathoms; Sitka; Crescent City, California.

Genus **Pristopus** Benedict.

PRISTOPUS VERRILLI Benedict.

Pristopus verrilli BENEDICT, Proc. U. S. Nat. Mus., xvii, 486, 1894.

Distribution.—Off Pribilof Islands, 688 fathoms, station 3501; off Sea Lion Rock, Washington, 859 fathoms, station 3075; off Cortez Bank, California, 984 fathoms, station 2919 (*Albatross*).

Genus **Leptolithodes** Benedict.

LEPTOLITHODES MULTISPINA Benedict.

Leptolithodes multispinus BENEDICT, Proc. U. S. Nat. Mus., xvii, 484, 1894.

Distribution.—Off Shumagin Bank, Alaska, 625 fathoms, station 3338; off Queen Charlotte Islands, British Columbia, 876 fathoms, station 2860; off Sea Lion Rock, Washington, 685 fathoms, station 3071; off San Diego, California, 822 fathoms, station 2923 (*Albatross*).

Genus **Lithodes** Latreille.

LITHODES RATHBUNI Benedict.

Distribution.—Off San Simeon Bay, California, 211 fathoms.

LITHODES CALIFORNIENSIS Benedict.

Distribution.—Off Santa Cruz Island, California, 155 fathoms.

LITHODES BREVIPES Milne Edwards and Lucas.

Lithodes brevipes MILNE EDWARDS and LUCAS, Arch. Mus. Hist. Nat. Paris, 11, 465, pls. xxiv-xxvii, 1841.—BENEDICT, Proc. U. S. Nat. Mus., xvii, 484, 1894.

Lithodes camtschaticus RICHTERS, Abh. Senck. Natur. Ges., Frankfurt, xiii, 404, plate, figs. 9, 10, 1884.

Distribution.—Bering Island; St. Paul Island, Pribilofs; off the Pribilofs, 25 to 47 fathoms; Unalaska; Kamchatka; Okhotsk Sea.

LITHODES CAMTSCHATICUS (Tilesius).

Maja camtschatica TILESIIUS, Mém. Acad. Impér. Sci. St. Pétersbourg, v, 1812, p. 336, pls. v and vi (1815).

Lithodes camtschensis LATREILLE, Cuvier's Règne Animal, 2nd ed., iv, p. 65, 1829.

Lithodes spinosissimus BRANDT, Bull. Phys.-Math. Acad. Impér. Sci. St. Pétersbourg, vii, 172, 1849 (young).—STIMPSON, Boston Jour. Nat. Hist., vi, 478, 1857.

Harriman Expedition.—Kadiak; Orca. Young specimens only.

Distribution.—Bering Sea (from Norton Sound) to Aleutian Islands to Orca, Prince William Sound, 5 to 49 fathoms. Kamchatka; Okhotsk Sea; Japan.

LITHODES ÆQUISPINA Benedict.

Lithodes aequispinus BENEDICT, Proc. U. S. Nat. Mus., XVII, 481, 1894.

Distribution.—Bering Sea (off the Pribilof Islands and north of Unalaska), 150 to 406 fathoms.

LITHODES COUESI Benedict.

Lithodes conesi BENEDICT, Proc. U. S. Nat. Mus., XVII, 481, 1894.

Distribution.—North of Unalaska and off Shumagin Bank, 399 and 625 fathoms.

Family GALATHEIDÆ.

Genus *Pleuroncodes* Stimpson.

PLEURONCODES PLANIPES Stimpson.

Distribution.—From 90 miles southwest of San Francisco, California, to 150 miles southwest of Cape St. Lucas, Lower California.

Genus *Galathea* Fabricius.

GALATHEA CALIFORNIENSIS Benedict.

Galathea californiensis BENEDICT, Proc. U. S. Nat. Mus., XXVI, 247, fig. 1, 1902.

Distribution.—Off Santa Cruz Island, California, 150 fathoms.

Genus *Munida* Leach.

MUNIDA QUADRISPINA Benedict.

Distribution.—From Sitka, Alaska, to San Diego, California, 50 to 559 fathoms.

Probably the species designated by Owen as *M. gregaria*.

Genus *Munidopsis* Whiteaves.

MUNIDOPSIS HYSTRIX Faxon.

Munidopsis hystrix FAXON, Bull. Mus. Comp. Zool., XXIV, 183, 1893; Mem. Mus. Comp. Zool., XVIII, 89, pl. XIX, fig. 1, 1895.

Distribution.—From off Anacapa Island, California, to off Acapulco, Mexico; 364 to 680 fathoms.

MUNIDOPSIS BERINGANA Benedict.

Munidopsis beringana BENEDICT, Proc. U. S. Nat. Mus., XXVI, 279, fig. 23, 1902.

Distribution.—Bering Sea, southwest of Pribilof Islands, 1771 fathoms.

MUNIDOPSIS VERRILLI Benedict.

Munidopsis verrilli BENEDICT, Proc. U. S. Nat. Mus., XXVI, 291, fig. 34, 1902.

Distribution.—California: Off Cortez Bank and off San Diego, 984 and 822 fathoms.

MUNIDOPSIS QUADRATA Faxon.

Munidopsis quadrata FAXON, Mem. Mus. Comp. Zool., XVIII, 97, pl. XXIII, fig. 1, 1895, and synonymy.

Distribution.—From off Destruction Island, Washington, to Tres Marias Islands, Mexico. Usually between 339 and 859 fathoms; also at 47 and 60 fathoms, off Wilmington, California, and Los Coronados Islands, respectively.

MUNIDOPSIS ASPERA (Henderson).

Elasmonotus asper HENDERSON, Ann. Mag. Nat. Hist. (5), XVI, 416, 1885; Rept. Challenger Anomura, 163, pl. XIX, fig. 4, 1888.

Munidopsis aspera FAXON, Bull. Mus. Comp. Zool., XXIV, 188, 1893; Mem. Mus. Comp. Zool., XVIII, 96, 1895.

Distribution.—From north of San Clemente Island, California, to Straits of Magellan; Galapagos; 69 to 782 fathoms. Brazil, 1500 fathoms (Henderson).

Family *ALBUNIDÆ*.Genus **Blepharipoda** Randall.**BLEPHARIPODA OCCIDENTALIS** Randall.

Blepharipoda occidentalis RANDALL, Jour. Acad. Nat. Sci. Phila., VIII, 131, pl. VI, 1839.

Distribution.—From San Francisco, California (D. S. Jordan), to San Quentin Bay and Rosalia Bay, Lower California.

Genus **Lepidopa** Stimpson.**LEPIDOPA MYOPS** Stimpson.

Distribution.—From San Diego, California, to Cape St. Lucas, Lower California.

Family *HIPPIDÆ*.Genus *Emerita* Gronovius, Benedict.

EMERITA ANALOGA (Stimpson).

Hippa analoga STIMPSON, Proc. Boston Soc. Nat. Hist., VI, 85, 1857. For synonymy, see Holmes.

Distribution.—According to Holmes, this species extends from Oregon to Panama. The collections in the National Museum range from Drake Bay, California, to San Bartolomé Bay, Lower California, and from Peru to Chile. The intermediate region (from Lower California to Panama) is represented by *E. emerita* (Fabricius), which occurs also on the Atlantic side of tropical America.

Family *PORCELLANIDÆ*.Genus *Petrolisthes* Stimpson.

PETROLISTHES CINCTIPES (Randall).

Distribution.—From Vancouver Island, British Columbia, to the Gulf of California.

PETROLISTHES ERIOMERUS Stimpson.

Distribution.—From Humboldt Bay to Pacific Grove, California.

Genus *Pachycheles* Stimpson.

PACHYCHELES RUDIS Stimpson.

Plate VI, fig. 6.

Distribution.—British Columbia to Santa Catalina Island, California; Lower California (Lockington).

PACHYCHELES PUBESCENS Holmes.

Distribution.—California, from Humboldt County to the Farallones.

Suborder *BRACHYURA*.Family *DORIPPIDÆ*.Genus *Clythrocerus* A. Milne Edwards and Bouvier.

CLYTHROCERUS PLANUS (Rathbun).

Plate IX, fig. 4.

Cyclodorippe plana RATHBUN, Amer. Nat., XXXIV, 519, 1900.

Carapace subcircular, a little broader than long; dorsally flat, finely granulate, the granules larger toward the outer margin; gastric and cardiac-intestinal regions bounded by deep grooves. The front is occupied by two triangular lobes, each tipped with a blunt tooth, and separated from each other by a broad V-shaped sinus, which is prolonged on the dorsal surface by a broad, shallow depression continued to the gastric region; outer margin of each lobe slightly concave. Outer orbital tooth narrow, blunt, well marked. A little in front of the middle of the lateral margin is a tooth somewhat larger than the orbital, and directed forward and slightly outward. At one third the distance from the orbital to this branchial tooth is a much smaller triangular tooth directed outward. The antennulæ are hidden under the carapace. The basal segment of the antennæ is moderately enlarged. The anterior end of the buccal cavern and of the merus of the outer maxillipeds project slightly in front of the median sinus of the front.

Chelipeds equal, rather short, stout, coarsely scabrous-granulate. Merus stout, unarmed. Carpus broader than long, having a shallow, plate-like blunt tooth along its outer surface, a short blunt tooth at inner angle. The palm is about as broad as long, bears a stout blunt spine or tooth on the outer side at the articulation of the carpus, and a lower, less conspicuous tooth at the articulation of the fingers; two feebly marked carinæ, one connecting the two teeth, the other lower down. The digits are longer than the upper margin of the palm, bent down, not gaping, the pollex much stouter than the dactylus, edges denticulate; the pollex has a superior longitudinal groove; its inner superior margin is subacute and continuous with that of the palm. Second pair of feet about twice as long as the carapace, dactylus longer than propodus. Third pair exceeding the second by half the length of the dactylus. Last two pairs of feet missing.

Color.—Carapace speckled with small black spots, in alcohol.

Dimensions.—Length of carapace of male, to end of horns, 3.4 mm., width 3.7 mm. Length of female 2.8 mm., width 3 mm.

Type locality.—Southern California, either at Catalina Harbor or Monterey (probably the former); W. H. Dall; 1 ♂, 1 ♀ (Cat. No. 14,256).

Additional specimen.—A female corresponding to the above was dredged in 1863 at Catalina Island by Dr. J. G. Cooper. With it is a male (Plate IX, fig. 5) a little larger and as long as wide (4.3 mm. long to end of horns and 4.2 mm. wide), which differs notably in the following particulars: The frontal lobes are prolonged in cylindrical blunt spines; the upper orbital margin has an inner rectangular sinus,

while the fissure next the outer tooth is larger than in the typical form; the first tooth of the lateral margin is nearer the posterior tooth than it is to the orbital tooth; the surface is more uneven, and more coarsely granulate. The legs are absent. I think the differences are not those of age, and indicate a distinct species, to which, however, I hesitate to give a name on account of the poor condition of the specimen.

Family *LEUCOSIIDÆ*.

Genus *Randallia* Stimpson.

RANDALLIA ORNATA (Randall).

Distribution.—From Mendocino County, California, to Magdalena Bay, Lower California; $5\frac{1}{2}$ to 51 fathoms.

Varies greatly in the prominence of the granules on the carapace.

RANDALLIA BULLIGERA Rathbun.

Distribution.—Off San Diego, California, 30 fathoms, and Magdalena Bay, Lower California, 12 fathoms.

Genus *Philyra* Leach.

PHILYRA PISUM de Haan.

Distribution.—Puget Sound; Japan; Korea; Philippine Islands.

Only one specimen of this species has been taken in Puget Sound, as noted by Calman.¹

Family *CALAPPIDÆ*.

Genus *Platymera* Milne Edwards.

PLATYMERGA GAUDICHAUDII Milne Edwards.

Distribution.—From the Farallones, California, to Panama; Chile; 26 to 218 fathoms.

Family *PARTHENOPIDÆ*.²

Genus *Heterocrypta* Stimpson.

HETEROCRYPTA OCCIDENTALIS (Dana).

Distribution.—From Gulf of the Farallones to San Diego, California, and Los Coronados Islands; 13 to 36 fathoms.

¹ Ann. N. Y. Acad. Sci., XI, 262, 1898.

² *Leiolambrus punctatissimus* (Owen) is not known to occur north of latitude $27^{\circ} 45' N$.

Family *MAIIDÆ*.Genus *Podochela* Stimpson.**PODOCHELA HEMPHILLII** (Lockington).

Plate x, fig. 2.

Distribution.—From San Luis Obispo, California, to Gulf of California. Recorded from 8 to 47 fathoms, and perhaps occurs in shallower water.

Genus *Anasimus* A. Milne Edwards.**ANASIMUS ROSTRATUS** Rathbun.

Plate x, fig. 4.

Distribution.—Southern California (either at Catalina Harbor or Monterey); northwest of Cerros Island, Lower California, 58 fathoms.

Genus *Erileptus* Rathbun.**ERILEPTUS SPINOSUS** Rathbun.

Plate x, fig. 1.

Distribution.—Off San Diego, California, 36 fathoms; also southern California (either at Catalina Harbor or Monterey). (W. H. Dall.)

Genus *Inachoides* Milne Edwards and Lucas.**INACHOIDES MAGDALENENSIS** Rathbun.

Distribution.—From Wilmington, California, to Gulf of California; $3\frac{1}{2}$ to 66 fathoms.

Genus *Oregonia* Dana.**OREGONIA GRACILIS** Dana.

Harriman Expedition.—Dutch Harbor, Unalaska; Juneau; Sitka.

Distribution.—From Bering Sea at Nunivak and Bering Island, to northern California; 5 to 135 fathoms.

OREGONIA BIFURCA Rathbun.

Plate vi, fig. 5.

Oregonia bifurca RATHBUN, Proc. U. S. Nat. Mus., xxiv, 885, 1902.

Carapace about three fourths as wide as long (rostrum included); width between tips of postorbital spines two thirds of the branchial width. Branchio-hepatic constriction very slight. Surface of carapace covered with tubercles from which proceed long yellow hairs, curved at the tips, making a tolerably thick coating. Rostrum not divided quite to the base;

horns slender, divergent, their outer margins almost longitudinal, their length along the inner margin about one eighth of the entire length of the carapace. Supraocular eave extending laterally not quite so far as in *O. gracilis*. Postocular spine narrow, as in *O. gracilis*, and directed a little more forward than in that species. The interantennular spine is curved a little more forward than in *O. gracilis*. Eyes a little stouter than in that species. Basal segment of antenna armed along its outer margin with one stout blunt subterminal spine and three small spines, one of which is at the anterior angle, and along its inner margin with one or two tubercles. Outer maxillipeds as in *O. gracilis*. Lower surface pubescent.

Chelipeds of the female of moderate size, one and a half times as long as carapace, subequal, shaped much as in *O. gracilis*. Inner surface of merus bordered by short blunt spines. Propodus slightly longer than merus, fingers and palm subequal, margins of palm subparallel, fingers fitting close together, denticulate. Ambulatory legs slender, diminishing gradually in length from the first to the fourth pair, the third pair being the length of the female cheliped. The dactyli are contained about one and a third times in their propodi. Chelipeds and ambulatory legs covered with long yellow hair, mixed with shorter and finer hair.

Dimensions.—Length of carapace and rostrum 26.5 mm., width of carapace 19.6 mm., width between tips of postorbital spines 13 mm., length of horn measured along the inner edge 3.4 mm., distance between tips of horns 3.5 mm.

Type locality.—North of Rat Islands, Aleutian Chain, 270 fathoms (*Albatross* station 3785), one adult female.

This species, by reason of the character of its orbits, maxillipeds, and trunk-legs, falls into the genus *Oregonia*, but differs from *O. gracilis* in its spreading horns, greater anterior breadth, different ornamentation of the basal antennal segment, etc.

Genus *Dasygygius* Rathbun.

DASYGYGIUS TUBERCULATUS (Lockington).

Plate x, figs. 3, 3a.

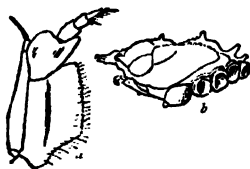


FIG. 92. *Dasygygius tuberculatus*. a. Maxilliped, much enlarged. b. Side view of carapace ($\times 18$).

Distribution.—From Alamitos Bay, California, to Panama Bay, including Gulf of California; 4 to 33 fathoms.

A fine series of specimens of this species was collected in San Diego Bay, 6 fathoms, by the *Albatross* (station 3620); the largest male measures 23 mm. long and 17.2 mm. wide.

Genus *Epialtus* Milne Edwards.

EPIALTUS PRODUCTUS Randall.

Distribution.—From British Columbia¹ to Lower California.

EPIALTUS NUTTALLII Randall.

Distribution.—From Santa Barbara, California, to Ballenas Bay, Lower California.

EPIALTUS BITUBERCULATUS Milne Edwards.

Epialtus bituberculatus MILNE EDWARDS, Hist. Nat. Crust., 1, 345, pl. xv, fig. 11, 1834.—RATHBUN, Bull. U. S. Fish Comm., 1900, vol. 2, p. 60 (1901), and synonymy.

Epialtus bituberculatus? var. *bermudensis* VERRILL, Trans. Conn. Acad. Sci., XI, 16, pl. 1, fig. 1, 1901.

Distribution.—Southern California (either Catalina Harbor or Monterey) to Chile; Indian River, Florida, to Rio de Janeiro; Bermudas.

Genus *Mimulus* Stimpson.

MIMULUS FOLIATUS Stimpson.

Distribution.—From Unalaska to Mazatlan, Mexico (A. Milne Edwards).

Genus *Pugettia* Dana.

PUGETTIA GRACILIS Dana.

Harriman Expedition.—Dutch Harbor, Unalaska (W. R. Coe); Kadiak (Coe); Fox Island (Kincaid); Virgin Bay (Coe); Orca; Yakutat; Sitka, 10 fathoms; Tongass Village (Coe).

Distribution.—From Aleutian Islands to southern California (Holmes); low tide to 40 fathoms.

PUGETTIA RICHII Dana.

Distribution.—British Columbia to San Diego, California; low tide.

PUGETTIA DALLI Rathbun.

Plate II, figs. 1, 1a.

Distribution.—From San Pedro, California, to San Geronimo Island, Lower California; 6½–30 fathoms.

¹The specimen recorded from Kiska Harbor, Alaska, was wrongly determined; it was overgrown with sponge and proved to be *Pugettia gracilis*.

Genus *Chorilia* Dana.

CHORILIA LONGIPES Dana.

Distribution.—From 57° north latitude, off Kadiak, Alaska, to 32° north latitude, off San Diego, California; 27–603 fathoms.

Genus *Chionæcetes* Kröyer.

CHIONÆCETES OPILIO (O. Fabricius).

Harriman Expedition.—Yakutat, in cod's mouth; Juneau, 20–50 fathoms.

Distribution.—From British Columbia northward to Bering Sea, thence eastward to Greenland, thence southward to Casco Bay, Maine; Kamchatka; Okhotsk Sea (off Robben Island); 3–206 fathoms.

CHIONÆCETES TANNERI Rathbun.

Distribution.—From Bering Sea to off San Diego, California (lat. 32° 17' N.); 29–1625 fathoms.

Genus *Hyas* Leach.

HYAS COARCTATUS Leach.

Distribution.—Circumpolar; Bering Sea; Kamchatka; Okhotsk Sea, as far south as Robben Island; Atlantic coast of America southward to off Cape Hatteras, North Carolina; northern Europe; 7–906 fathoms.

HYAS LYRATUS Dana.

Harriman Expedition.—Berg Bay, Glacier Bay; Juneau, 50 fathoms.

Distribution.—From Bering Sea (off Kululak Bay and at the extreme end of the Aleutian Islands) to Puget Sound; 5–110 fathoms.

Genus *Pelia* Bell.

PELIA TUMIDA (Lockington).

Distribution.—Santa Catalina Island, California, to Magdalena Bay, Lower California.

PELIA PACIFICA Milne Edwards.

Distribution.—From Santa Catalina Island, California, to Bay of Panama; 10–40 fathoms.

Genus *Loxorhynchus* Stimpson.

LOXORHYNCHUS GRANDIS Stimpson.

Distribution.—From the Farallones and San Francisco to San Diego, California; $6\frac{1}{2}$ –68 fathoms.

LOXORHYNCHUS CRISPATUS Stimpson.

Distribution.—From the Farallones to San Diego, California; 4–53 fathoms.

Genus *Scyra* Dana.

SCYRA ACUTIFRONS Dana.

Distribution.—From Kadiak, Alaska, to San Diego, California. Low tide to 40 fathoms.

Genus *Rhodia* Bell.

RHODIA PARVIFRONS (Randall).

Herbstia parvifrons RANDALL, Jour. Acad. Nat. Sci. Phila., VIII, 107, 1839.

—HOLMES, Occas. Papers Calif. Acad. Sci., VII, 38, 1900.

Herbstia (Herbstiella) camptacantha HOLMES, *op. cit.*, p. 37, and synonymy.

Rhodia parvifrons RATHBUN, Amer. Nat., XXXIV, 511, 1900.

Distribution.—From San Pedro, California, to Acapulco, Mexico; 30–40 fathoms.¹

Family CANCRIDÆ.

Genus *Cancer* Linnaeus.

CANCER PRODUCTUS Randall.

Harriman Expedition.—Fox Island (T. Kincaid).

Distribution.—From Kadiak, Alaska, to Magdalena Bay, Lower California.

CANCER AMPHICETUS Rathbun.

Plate VI, fig. 3.

Trichocarcinus dentatus MIERS, Proc. Zool. Soc. London, 1879, p. 34; not

Cancer dentatus BELL, 1835; nor *C. dentatus* HERBST, 1785.

Cancer amphicetus RATHBUN, Proc. U. S. Nat. Mus., XXI, 582, 1898.

Distribution.—From San Diego Bay, California, to Magdalena Bay, Lower California; Japan; Korea; $11\frac{1}{2}$ –169 fathoms.

Size.—Specimens from Magdalena Bay, in the Museum of Compara-

¹ *Libinia emarginata* Leach, included in Holmes's list on the authority of Randall, I have omitted, because so many errors have been discovered in the localities cited by Randall that the existence of this species on the west coast of America needs verification.

tive Zoology, measure as follows: Male, length 24.2 mm., width 33.4 mm.; female, length 18.7 mm., width 25 mm.

CANCER ANTENNARIUS Stimpson.

Distribution.—Queen Charlotte Sound, British Columbia, to Magdalena Bay, Lower California. Shallow water to 7 fathoms.

CANCER GIBBOSULUS (de Haan).

Corystes (Trichocera) gibbosula DE HAAN, Fauna Japon., 45, pl. II, fig. 4, pl. XIII, fig. 3, 1835.

Trichocarcinus gibbosulus MIERS, Proc. Zool. Soc. London, 1879, p. 34.

Cancer gibbosulus RATHBUN, Proc. U. S. Nat. Mus., XXI, 581, 1898.

Distribution.—From Granite Cove, Port Althorp, Alaska, to San Geronimo Island, Lower California; Japan. Shallow water to 40 fathoms.

CANCER ANTHONYI Rathbun.

Plate VI, fig. 2.

Cancer anthonyi RATHBUN, Proc. Biol. Soc. Wash., XI, 111, 1897; Amer. Nat., XXXIV, 134, 1900.

Distribution.—Long Beach, California (H. N. Lowe); Playa Maria Bay, Lower California.

Size.—Among the specimens taken by Mr. Lowe from the wharf at Long Beach is a male somewhat larger than the type, measuring 52.1 mm. long and 77.5 mm. wide.

CANCER JORDANI Rathbun.

Plate VI, fig. 4.

Cancer jordani RATHBUN, Amer. Nat., XXXIV, 133, 1900.

A small species allied to *C. magister* and *C. antennarius*.

Female.—Length of carapace one and a fourth times width. Surface hairy and covered with small crowded scabrous granules. Regions indicated by narrow and shallow depressions. Teeth of front and lateral border not thickened as in *C. antennarius*; inner orbital tooth very slightly produced; margin of upper orbital tooth almost transverse, scarcely denticiform. Lateral teeth separated to their bases, tips spiniform and curved forward; second, fourth, sixth, and eighth teeth smaller than the others (the outer orbital tooth reckoned as the first); ninth tooth scarcely more prominent than eighth. No postero-lateral tooth. Basal antennal tooth and the adjoining tooth of the orbital margin acute. Movable part of antennæ half as long as carapace. The outer maxillipeds overlap con-

siderably the basal joint of the antennæ; merus longer than wide. The palms of the chelipeds have 2 superior and 5 external carinæ fringed with hair. On the prehensile edges of the fingers the dark color runs from the proximal end of the fingers nearly to the tip, but on the outer edges the dark color begins near the middle of the fingers.

Dimensions.—Female, length 15.5 mm., width 19.5 mm., length of movable part of antenna 7.5 mm., fronto-orbital width 9 mm. A male is about 20 mm. long, but too damaged for measurement.

Distribution.—Monterey Bay, California (Harold Heath), one under rocks between low tide mark and mean tide, and three from the sub-umbrella space of a large violet-and-white jellyfish (type locality, Cat. No. 22,868). Young specimens were taken by John C. Brown at Pacific Grove, and by H. N. Lowe at San Pedro, California.

Relations.—This species may have been confounded with the young of better known species. The young of *C. magister* has a nearly naked carapace, the ninth tooth of the lateral margin is produced sideways, the antennæ are less than twice as wide as front, the merus of the maxillipeds is no broader than long, the carinæ of the upper and outer surfaces of the hand are 6 instead of 7.

The carapace of young *C. antennarius* is also nearly naked (Dr. Holmes may have had in his hand *C. gibbosulus* when he described the carapace of young *C. antennarius* as thickly covered with hair); the teeth are all much thickened, the orbital teeth prominent, the two underneath being rounded, not sharp; the maxillipeds reach only to the base of the antennal segment, the merus not broader than long; the dark color on the fingers is more extensive than in *C. jordani*.

Cancer gibbosulus has a much more uneven carapace, strongly marked and rounded orbital teeth, a postero-lateral tooth, ninth tooth more prominent than eighth. Carapace hairy, as in *C. jordani*.

In *C. anthonyi* the antero-lateral teeth are low and broad, not alternately large and small, the first 6 having blunt angles; the inner supra-orbital tooth is well developed.

CANCER MAGISTER Dana.

Harriman Expedition.—Berg Bay, Glacier Bay.

Distribution.—Unalaska to Magdalena Bay, Lower California. Low water to 50 fathoms.

CANCER GRACILIS Dana.

Distribution.—Kasaan Bay, Prince of Wales Island, Alaska, to Playa Maria Bay, Lower California. Shallow water to 56 fathoms.

CANCER OREGONENSIS (Dana).

Plate VII, fig. 1.

Trichocera oregonensis DANA, Proc. Acad. Nat. Sci. Phila., VI, 86, 1852;

Crust. U. S. Expl. Exped., I, 299, 1852, pl. XVIII, fig. 5, 1855.

Platycarcinus recurvidens BATE, Proc. Zool. Soc. London, 1864, 663.

Trichocarcinus oregonensis MIERS, Proc. Zool. Soc. London, 1879, 34.—

HOLMES, Occas. Papers Calif. Acad. Sci., VII, 54, 1900, and synonymy.

Trichocarcinus recurvidens WALKER, Trans. Liverpool Biol. Soc., XII, 271, pl. XV, figs. 1-1b, 1898.

Trichocarcinus Walkeri HOLMES, *op. cit.*, 53.

Harriman Expedition.—Fox Island (Kincaid); Virgin Bay (Coe); Orca; Yakutat; Sitka.

Distribution.—Aleutian Islands to Lower California (Holmes). Low water to 238 fathoms.

I am unable to separate from typical *C. oregonensis* the form described by Walker under the specific name *recurvidens*, and later by Holmes as *Trichocarcinus walkeri*, because the species displays more variation and intergradation than was known to those authors. Material from 43 localities has been examined. In a lot of specimens collected by Dr. Dall at Coal Harbor, Unga Island, Alaska, are not only typical *oregonensis* and typical *walker*i, but some with sculpturing and teeth intermediate between the two; others more deeply areolated than in typical *walker*i, but with teeth as narrow and well separated as in the other extreme of *oregonensis*. In a lot of fairly typical *oregonensis* from the Strait of Fuca (D. S. Jordan) is one in which many of the granules of the areolæ are prolonged into conical spines. Still another variation is shown by a single male (plate VII, fig. 1) from station 3274 (*Albatross*), northeast of Amak Island, Alaska, 19 fathoms, where the lateral teeth are broader and more overlapping than in the specimen figured by Walker (*loc. cit.*); the granulate areolæ are small, round, and raspberry-like, the interspaces much smoother than usual.

Size.—The largest specimen measured is a female from Puget Sound (O. B. Johnson), 36.5 mm. long, 47.1 mm. wide.

Cancer oregonensis might well be set apart generically on account of the antero-lateral margins not being sharply marked off from the postero-lateral, in which respect it differs from the other species of *Cancer*, including *C. gibbosulus* and *C. amphiat*us. The name *Trichocarcinus* is not, however, available for the species *oregonensis*, as the type of *Trichocarcinus* Miers, substituted for *Trichocera* de Haan, preoccupied, is *Cancer gibbosulus* (de Haan). This species I consider a true *Cancer* (see p. 176); therefore *Trichocarcinus* is a synonym of *Cancer*.

Genus **Telmessus** White.**TELMESSUS CHEIRAGONUS** (Tilesius).

Cancer cheiragonus TILESIIUS, Mém. Acad. Impér. Sci. St. Pétersbourg, v, 347, pl. VII, fig. 1, 1815.

Telmessus cheiragonus BENEDICT, Proc. U. S. Nat. Mus., xv, 224, pls. xxv and xxvi, figs. 2, 3, and 4, 1892.

Telmessus cheiragonus HOLMES, Occas. Papers Calif. Acad. Sci., VII, 69, 1900, and synonymy.

Harriman Expedition.—Popof Island, Shumagins; Fox Island, Prince William Sound (Kincaid).

Distribution.—Northeastern Siberia; Kamchatka; Kurile Islands; Bering Sea to California (Holmes). Low water to 20 fathoms.

Note on specimens from the type locality.—Since the publication of Dr. Benedict's 'Corystoid Crabs of the Genera *Telmessus* and *Erimacrus*,' Dr. Leonhard Stejneger has collected specimens of *Telmessus* at Avacha Bay, Kamchatka, the type locality of *Cancer cheiragonus* Tilesius. These specimens are identical with *T. cheiragonus*, as figured by Benedict; otherwise the exaggerated lateral spines and the aculeate front of Tilesius's figure would lead one to suppose that his was a different species.

Genus **Erimacrus** Benedict.**ERIMACRUS ISENBECKII** (Brandt).

Platycorystes (Podacanthus) isenbeckii BRANDT, Bull. Phys.-Math. Acad. Impér. Sci. St. Pétersbourg, VII, 180, 1848; Middendorff's Sibirische Reise, Bd. II, Theil I, p. 83, 1851.

Cheiragonus isenbeckii BRANDT, Middendorff's Sibirische Reise, Bd. II, Theil I, p. 147, 1851.

Platycorystes isenbeckii RICHTERS, Abh. Senck. Natur. Gesell., Frankfurt, XIII, Heft 4, p. 402, plate, figs. 1 and 2, 1884.

Erimacrus isenbeckii BENEDICT, Proc. U. S. Nat. Mus., xv, 229, pl. xxvi, figs. 5, 6, and 7, pl. xxvii, 1892.

Distribution.—Bering Sea, Aleutian Islands, and Alaska Peninsula. Shallow water to 85 fathoms.

Family **PORTUNIDÆ**.Genus **Portunus** Fabricius.**PORTUNUS XANTUSII** Stimpson.

Distribution.—From Puget Sound to Chile (A. Milne Edwards). Except for a single specimen taken by the *Albatross* in Puget Sound, this species is not known north of San Pedro, California.

Genus *Callinectes* Stimpson.

CALLINECTES BELLICOSUS (Stimpson).

Distribution.—Point Loma, California, to Gulf of California.

Family PILUMNIDÆ.¹Genus *Cycloxanthops* Rathbun.

CYCLOXANTHOPS NOVEMDENTATUS (Lockington).

Plate VII, fig. 10.

Distribution.—San Pedro, California, to Guadalupe Island and San Martin Island, Lower California.

CYCLOXANTHOPS RUGOSUS Holmes.

Distribution.—San Diego, California.

Genus *Lophopanopeus* Rathbun.

LOPHOPANOPEUS BELLUS (Stimpson).

Xantho bella STIMPSON, Ann. Lyc. Nat. Hist. N. Y., VII, 204, pl. V, fig. 2, 1860.

Lophoxanthus bellus A. MILNE EDWARDS, Crust. Rég. Mex., 257, pl. XLVI, fig. 4, 1879 (part).—HOLMES, Occas. Papers Calif. Acad. Sci., VII, 60, pl. 1, fig. 3, 1900, and synonymy.

Lophopanopeus bellus RATHBUN, Bull. Lab. Nat. Hist. State Univ. Iowa, IV, 272, 1898.

Harriman Expedition.—Prince William Sound, at Fox Island (Kincaid) and Virgin Bay (Coe). This is the most northern locality known for this species.

Distribution.—Prince William Sound; Kasaan Bay, Prince of Wales Island, Alaska (U. S. Nat. Mus.); Vancouver Island, British Columbia to Monterey, California (type locality of *Xanthodes hemphillii* Lockington). Lower California (A. Milne Edwards).

The figure given by A. Milne Edwards resembles *L. bellus* more than it does any of the other species here described; the locality given is Lower California.

There are on the Pacific coast six closely allied species of *Lophopanopeus*; some of these have been confused with *L. bellus* and *L. leucomanus*; therefore the published localities from which I have not examined specimens are accepted with a reservation.

¹ I have concluded to omit *Daira americana* Stimpson from the list until it is known that the species really occurs in California in contradistinction to Lower California.

The characters most useful in determining the species are given below:

The carapace is roughened antero-laterally, but not conspicuously so.

The frontal lobes are slightly sinuous and oblique, the outer tooth faintly indicated.

The anterior margin of the third antero-lateral tooth (or tooth N of Dana) is in line with the truncate margin of the second tooth or the one coalesced with the outer orbital tooth.

The carpus of the chelipeds is slightly roughened.

The hand is smooth, without a tooth on the upper margin; the proximal end of the inner margin of the upper surface is, however, well marked.

The dark color of the fingers does not run back on the palm.

The carpal joints of all the ambulatory legs are slightly bilobed on the anterior or upper margin.

The propodal joints have a convex anterior margin without lobes.

Dimensions.—Male, length 22.5 mm., width 33.8 mm., proportion of length to width 1:1.5, fronto-orbital width 16 mm., proportion of fronto-orbital width to width of carapace 1:2.11.

LOPHOPANOPEUS FRONTALIS Rathbun.

Plate VII, fig. 8.

Distribution.—San Diego, California. The locality 'Monterey' cited for this species is an error.

The carapace is almost smooth.

The frontal lobes are markedly oblique and sinuous, the middle lobes very convex.

The third antero-lateral tooth is more produced than the second tooth.

The carpus of the chelipeds is smoother than in *L. bellus*.

The hand is smooth, with a large tooth projecting inward on the inner side of the upper margin and extending half the length of the upper margin.

The dark color of the fingers runs back on the palm; in this respect differing from all other allied species.

The carpal joints of all the ambulatory legs are slightly bilobed on the anterior or upper margin.

The propodal joints have a convex anterior margin, but are narrower than in *L. bellus*.

Dimensions.—Male, length 17.2 mm., width 23.7 mm., proportion of length to width 1:1.32, fronto-orbital width 12.5 mm., proportion of fronto-orbital width to width of carapace 1:1.9.

LOPHOPANOPEUS HEATHII Rathbun.

Plate VII, fig. 9.

Lophopanopeus heathii RATHBUN, Amer. Nat., XXXIV, 137, 1900.*Lophoxanthus leucomanus* HOLMES, Occas. Papers Calif. Acad. Sci., VII, 61, 1900 (part).

Distribution.—Specimens are in the National Museum from Monterey Bay, California, under stones, mean and low tide mark (II. Heath; types, Cat. No. 22,870); Monterey Bay (J. O. Snyder); Catalina Island. Others also from Monterey and Catalina Island, and belonging to the Museum of the California Academy of Sciences, have been examined.

The carapace is smooth except on the outer half of the hepatic region, where it is slightly roughened.

The margin of the frontal lobes is slightly oblique, the outer tooth inconspicuous.

The anterior margin of the third antero-lateral tooth is in line with the second tooth.

The carpus of the chelipeds is smooth, or nearly so.

The hand is smooth, one tooth on inner side of upper margin.

The dark color of the fingers does not run back on the palm.

The carpal joints of the ambulatory legs have the anterior or upper margin slightly bilobed.

The propodi have slightly convex anterior margins.

Dimensions.—Male, length 12.2 mm., width 16.5 mm., proportion of length to width 1 : 1.35, fronto-orbital width 11.6 mm., proportion of fronto-orbital width to width of carapace 1 : 1.42.

While the antero-lateral teeth resemble those of *L. bellus*, the smooth surface and the tooth on the manus ally it closely to *L. frontalis*.

LOPHOPANOPEUS LEUCOMANUS (Lockington).

Xanthodes leucomanus LOCKINGTON, Proc. Calif. Acad. Sci., VII, 32, 1877 (not *X. leucomanus*, op. cit., p. 100).

Lophoxanthus bellus A. MILNE EDWARDS, Crust. Rég. Mex., 257, 1879 (part).

Lophopanopeus leucomanus RATHBUN, Bull. Lab. Nat. Hist. State Univ. Iowa, IV, 272, 1898.

Lophoxanthus leucomanus HOLMES, Occas. Papers Calif. Acad. Sci., VII, 61, pl. 1, fig. 4, 1900 (part).

Distribution.—From Monterey to San Diego, California: San Pedro, Catalina Island, and San Diego (National Museum); Monterey, Santa Rosa Island, and San Diego (Lockington). Types not extant (Holmes).

The anterior half of the carapace is deeply rugose, the roughness on the hepatic region not divided from that on the two adjacent teeth.

The frontal lobes are strongly oblique, except the outer tooth, which is not strongly marked.

The third antero-lateral tooth is more produced than the second tooth.

The carpus of the chelipeds is covered with numerous small irregular pits separated by reticulating lines.

The upper portion of the hand is pitted and reticulated like the carpus, and has two or more irregular inward-pointing teeth on upper margin, the proximal the larger.

The color of the fingers does not run back on the palm.

The carpal joints of the ambulatory legs have on the anterior or upper margin a very thin crest, strongly bilobed.

The propodal joints are wide, and have a prominent lobe at the proximal end.

Dimensions.—Male, length 8.7 mm., width 11.6 mm., proportion of length to width 1 : 1.33; fronto-orbital width 7.1 mm., proportion of fronto-orbital width to width of carapace 1 : 1.63.

LOPHOPANOPEUS LOCKINGTONI Rathbun.

Plate VII, fig. 7.

Xanthodes leucomanus LOCKINGTON, Proc. Calif. Acad. Sci., VII, 100, 1877 (not *X. leucomanus*, *op. cit.*, p. 32).

Lophoxanthus bellus A. MILNE EDWARDS, Crust. Rég. Mex., 257, 1879 (part).

Lophoxanthus leucomanus HOLMES, Occas. Papers Calif. Acad. Sci., VII, 61, 1900 (part).

Lophopanopeus lockingtoni RATHBUN, Amer. Nat., XXXIV, 137, 1900.

Distribution.—San Diego Bay, California, to Gulf of California. Specimens examined from San Diego Bay, 4½ fathoms (*Albatross*, type locality); San Diego (H. Hemphill); San Diego (Cal. Acad. Sci.); Gulf of California at La Paz, 3 fathoms, Mulege Bay, and Port Escondido (specimens described by Lockington, *op. cit.*, p. 100, not p. 32).

The anterior half of the carapace is irregularly roughened; the obliquely oval granulated patch on the hepatic region is separated from the granules on the adjacent teeth.

The frontal lobes are slightly oblique, but the outer tooth is well marked.

The third antero-lateral tooth is more produced than the second tooth.

The carpus of the chelipeds is crossed by a few thickened ridges incompletely reticulating, anterior margin having a thick granulated ridge distinctly separated by a deep sulcus from the rest of the carpus; a large granulated tubercle near articulation with hand.

The upper margin of the hand has two longitudinal ridges, the outer straight, the inner curved and ending proximally in a tooth; outer surface of hand granulate, the granules tending to form in longitudinal and transverse lines, and becoming fainter toward the fingers.

The dark color of the fingers does not run back on the palm.

The carpal joints of the ambulatory legs are distinctly but not markedly bilobed on the anterior or upper margin.

The propodal joints have a slightly convex anterior margin.

Dimensions.—Male, length 9.6 mm., width 13.3 mm., proportion of length to width 1:1.39; fronto-orbital width 7.9 mm., proportion of fronto-orbital width to width of carapace 1:1.68.

LOPHOPANOPEUS DIEGENSIS Rathbun.

Plate IX, fig. 3.

Lophopanopeus diegensis RATHBUN, Amer. Nat., XXXIV, 137, 1900.

Distribution.—Off Point Conception, California, 31 fathoms (*Albatross* station 2908); San Diego, 10 fathoms (H. Hemphill), one male, type (Cat. No. 4281).

The carapace has a few granulate lines on the antero-lateral regions.

The frontal lobes are slightly oblique and sinuous, the outer tooth inconspicuous. The front is deflexed so that its true edge does not show in the view figured.

The second antero-lateral tooth, though small, is dentiform and not merged with the first or orbital. The third, fourth, and fifth teeth are prominent, carinate, and subacute.

The carpus of the chelipeds has about 35 unequal tubercles, irregularly placed, some of them forming lines.

The hand is bicarinate above, the inner carina having a small prominence at the proximal end; a few tubercles on upper part of inner surface; upper and proximal portion of outer surface rough with fine granulated rugæ.

The dark color of the fingers does not run back on the palm.

The carpal joints of all the ambulatory legs have on the anterior margin two prominent naked truncate tubercles, by which this species may at once be recognized.

The propodal joints of the last two pairs have a smaller similar lobe at the proximal end of the anterior or upper margin.

Dimensions.—Male, length 7.9 mm., width 11.4 mm., proportion of length to width 1:1.44; fronto-orbital width 6.6 mm., proportion of fronto-orbital width to width of carapace 1:1.37.

Genus **Xanthias** Rathbun.**XANTHIAS TAYLORI** (Stimpson).

Distribution.—Monterey, California, to Magdalena Bay, Lower California. Beach to 55 fathoms.

Size.—Unusually large individuals have been collected at Pacific Grove, California, by John C. Brown. An egg-laden female measures 24.6 mm. long on the median line of the carapace, and 42 mm. wide.

XANTHIAS LATIMANUS (Lockington).

Distribution.—San Diego, California (Lockington).

Species not seen since Lockington's record.

Genus **Pilumnus** Leach.**PILUMNUS SPINOHIRSUTUS** Lockington.

Plate VII, fig. 2.

Distribution.—San Diego, California, and Gulf of California; 10–22 fathoms. Bay of St. Elena, Ecuador (Nobili).

Genus **Heteractæa** Lockington.**HETERACTÆA LUNATA** (Milne Edwards and Lucas).

Pilumnus lunatus MILNE EDWARDS and LUCAS, D'Orbigny's Voy. l'Amér. Mérid., Crust., 20, 1843, pl. IX, fig. 2, 1847.

Heteractæa lunata KINGSLEY, Proc. Acad. Nat. Sci. Phila., 1879, 396 (1880).

Distribution.—San Diego, California (Faxon) to Chile.

Family **PINNOTHERIDÆ**.Genus **Pinnotheres** Latreille.**PINNOTHERES NUDUS** Holmes.

Distribution.—Monterey and Santa Cruz, California.

PINNOTHERES PUGETTENSIS Holmes.

Distribution.—Puget Sound, in branchial cavity of a *Halocynthia*.

Genus **Raphonotus** Rathbun

(= *FABIA* Dana).

Raphonotus RATHBUN, Proc. Biol. Soc. Washington, XI, 166, 1897.

RAPHONOTUS SUBQUADRATUS (Dana).

Fabia subquadrata HOLMES, Occas. Papers Calif. Acad. Sci., VII, 87, 1900 (part).

Distribution.—Alaska to Monterey, California. Specimens are in the National Museum from: South entrance to Akutan Pass, Alaska, 45 fathoms (*Albatross* station 2843); Monterey, in folds of *Lucapina crenulata* (Dr. C. A. Canfield); Pacific Grove, from mantle cavity of *Mytilus edulis* (John C. Brown).

I believe that the specimens recorded from farther south than Monterey Bay are a distinct species from *R. subquadratus*. Those seen and described by Dr. Holmes from San Pedro as *Fabia subquadrata* are the species which follows, *R. lowei*.

RAPHONOTUS LOWEI Rathbun.

Fabia subquadrata HOLMES, Occas. Papers Calif. Acad. Sci., VII, 87, 1900 (part).

Raphonotus lowei RATHBUN, Amer. Nat., XXXIV, 590, 1900.

General appearance like that of *R. subquadratus*; differs as follows:

In *R. lowei* the turned-down front has no trace of a transverse groove and is naked; in *R. subquadratus* the turned-down front has a shallow transverse sulcus which is covered with pubescence.



In *R. lowei* the last joint of the maxilliped does not reach the end of the penultimate joint, as it does in *R. subquadratus*.



FIG. 93. *Raphonotus lowei*. ♀. San Pedro Bay. a. Endognath of outer maxilliped ($\times 8$). b. Chela ($\times 34$).

In *R. lowei* the palm of the chela does not widen distally; its margins are subparallel or a little convex; its lower surface has only one line of hair, which is continued to the end of the pollex; in *R. subquadratus* the palm widens a little distally, as figured by Dana, and is furnished with two rows of hair below, the inner one of which is continued to the end of the pollex.

In *R. lowei* the fingers are less arched and less gaping than in *R. subquadratus*.

The carapace is also a little wider in our species.

Dimensions.—Female, length of carapace 10 mm., width 12.5 mm., length of merus of third ambulatory leg 5 mm.

Distribution.—San Pedro to San Diego, California: San Pedro Bay, in siphon of *Pholas pacifica*, collected by H. N. Lowe, for whom the species is named (type locality); San Pedro, in shell of *Tapes* (Holmes, as *Fabia subquadrata*); San Diego (H. Hemphill), one of the specimens

examined is from *Pachydesma crassatelloides*. Recorded by Lockington from the same locality, commensal, and collector, under the name of *Fabia subquadrata*.

Genus *Pinnixa* White.

PINNIXA OCCIDENTALIS Rathbun.

Plate VII, fig. 4; plate IX, figs. 6, 6a.

Distribution.—Unalaska to Humboldt County, California (Holmes). Shallow water to 238 fathoms.

The specimen recorded by me in 1893, from San Diego, is *P. littoralis* Holmes.

Harriman Expedition.—Juneau, 20 fathoms; Hot Springs; Sitka; Wrangell, in burrows of *Echiurus* (T. Kincaid); Cape Fox.

This species shows remarkable variation in the length and breadth of the ambulatory legs, especially of the third pair, as is shown in the accompanying table:

Sex.	Station.	Length of carapace.	Width of carapace.	Length of merus of third ambulatory leg.	Width of merus of third ambulatory leg.
♂	2862	7.5 mm.	15.8 mm.	8.7 mm.	2.8 mm.
	Wrangell	6	12	5.1	2.1
♀	2862	7.3	14.5	7	2.6
	Wrangell	7	14.2	5.5	3.1

I was at first led to believe that the Wrangell specimens represented a distinct species, but a reëxamination of the entire collection of *P. occidentalis* shows intermediate forms. It may be added that station 2862, which yielded the longest and slenderest legs, is also the greatest depth (238 fathoms) from which the species is known.

Small specimens often exhibit an almost complete absence of the cardiac ridge.

PINNIXA CALIFORNIENSIS Rathbun.

Plate VII, fig. 3.

Distribution.—From off Point Ano Nuevo, California, to Magdalena Bay, Lower California; 13 to 51 fathoms.

PINNIXA TUBICOLA Holmes.

Distribution.—From Puget Sound to San Diego, California. Taken by the *Albatross* off Point Conception, California, 31 fathoms, station 2908; in calcareous tube of worm, Trinidad, California (Holmes).

PINNIXA LITTORALIS Holmes.

Distribution.—Bodega Bay to San Diego, California.

PINNIXA LONGIPES (Lockington).

Distribution.—Tomales Bay to San Pedro, California. In tube of annelid (*Clymenella*).

PINNIXA FABA (Dana).

Distribution.—From Sitka, Alaska, to San Pedro, California. In shells of large bivalve mollusks, and in the cloaca of a large holothurian, *Liosoma arenata* Stimpson.

Genus Scleroplax Rathbun.**SCLEROPLAX GRANULATA** Rathbun.

Plate VII, fig. 5.

Distribution.—From Bodega Bay, California, to Ensenada, Lower California.

Genus Parapinnixa Holmes.**PARAPINNIXA AFFINIS** Holmes.

Distribution.—Deadman Island, San Pedro, California.

Genus Cryptophrys Rathbun.**CRYPTOPHRYS CONCHARUM** Rathbun.

Plate VII, fig. 6.



FIG. 94. *Cryptophrys concharum*. Outer maxillipeds ($\times 8$). Pacific Grove, Calif.

Distribution.—From Puget Sound to San Diego, California. From mantle of *Mya arenaria* Linnæus, *Cardita borealis* Conrad, and *Mytilus edulis* Linnæus.

Genus Opisthopus Rathbun.**OPISTHOPUS TRANSVERSUS** Rathbun.

Plate IX, fig. 2.

Distribution.—From Monterey to San Diego, California. In *Lucapina crenulata* Sowerby, siphon of *Pholas*, and mantle cavity of *Mytilus edulis*. The suture dividing the ischium from the merus of the maxillipeds is obsolescent; while in most specimens it is deep on the ventral surface, in none is it evident on the upper surface.



FIG. 95. *Opisthopus transversus*. 9. Endognath of outer maxilliped ($\times 60$). Pacific Grove.

Family *GRAPSIDÆ*.Genus *Pachygrapsus* Randall.*PACHYGRAPSUS CRASSIPES* Randall.

Distribution.—From Oregon to Gulf of California; Japan; Korea. The locality Sandwich Islands, given by Randall, is too doubtful to be relied upon.

PACHYGRAPSUS TRANSVERSUS Gibbes.

Distribution —From California to Peru; Galapagos Islands; Oriental region; West Africa; Bermudas; Bahamas and Florida Keys to Rio de Janeiro.

Genus *Hemigrapsus* Dana.*HEMIGRAPUS NUDUS* (Dana).

Brachynotus nudus HOLMES, Occas. Papers Calif. Acad. Sci., VII, 81, 1900, and synonymy.

Hemigrapsus nudus RATHBUN, Amer. Nat., XXXIV, 587, 1900.

Harriman Expedition.—Sitka, 10 fathoms; Metlakatla, Alaska; Grenville Channel, British Columbia.

Distribution.—From Sitka to Gulf of California.

HEMIGRAPUS OREGONENSIS (Dana).

Brachynotus oregonensis HOLMES, *op. cit.*, 82, and synonymy.

Hemigrapsus oregonensis RATHBUN, *loc. cit.*

Harriman Expedition.—Fox Island, Prince William Sound (T. Kincaid); Yakutat; Sitka, 10 fathoms; Metlakatla; Grenville Channel, British Columbia.

Distribution.—From Prince William Sound, Alaska, to Gulf of California. Fox Island is farther north than the species has been collected hitherto.

Genus *Grapsodius* Holmes.*GRAPSODIUS EXIMIUS* Holmes.

Distribution.—San Diego, California.

Genus *Planes* Leach.*PLANES MINUTUS* (Linnæus).

Distribution.—Temperate and tropical seas. Specimens are in the National Museum from lat. 41° N., long. 141° W., at sea west of Humboldt Bay, California (W. H. Dall, 1871); California (D. S. Jordan,

1880); Point Loma, California; and off San Diego (*Albatross station* 2928).

Family *OCYPODIDÆ*.

Genus *Ocypode* Fabricius.

OCYPODE GAUDICHAUDII Milne Edwards and Lucas.

Distribution.—The normal range of this species is from Nicaragua (Gulf of Fonseca) to Chile and Galapagos Islands; Honolulu (Cano). Three young specimens from San Pablo, California, are in the Museum of Comparative Zoology, determined by Dr. Faxon.

Genus *Uca* Leach.

UCA CRENULATA (Lockington), 1877.

(= *Gelasimus gracilis* RATHBUN, 1893 = *G. macrodactylus* BOUVIER, 1895, not Milne Edwards and Lucas = *U. stenodactyla* ORTMANN, 1897, part (specimen from San Diego), not Milne Edwards and Lucas.)

Distribution.—From San Diego, California, to Gulf of California.

Genus *Speocarcinus* Stimpson.

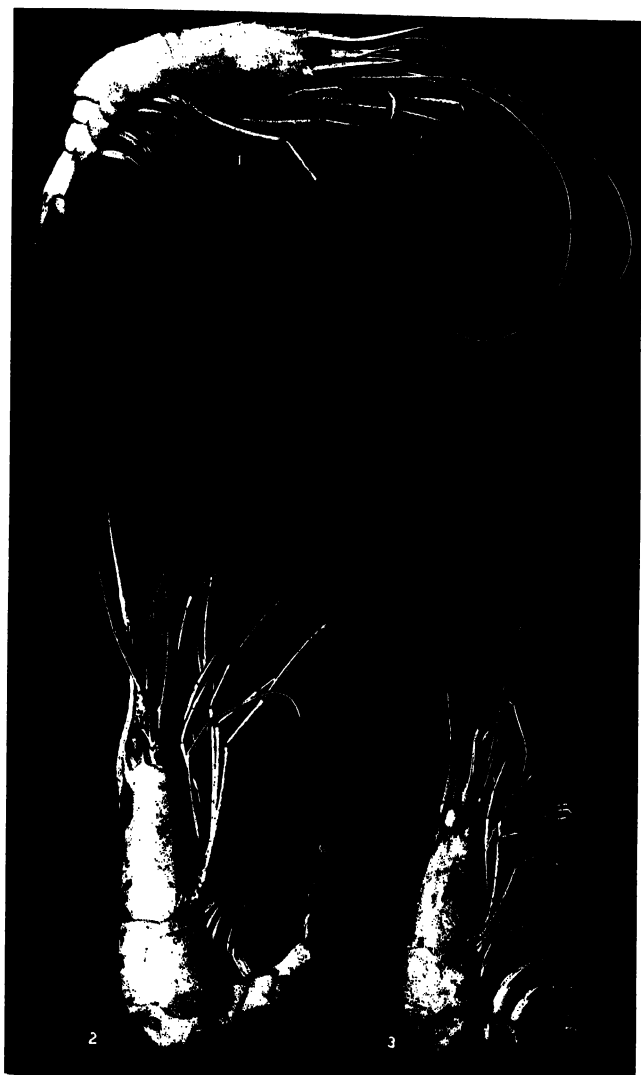
SPEOCARCINUS CALIFORNIENSIS (Lockington).

Plate ix, fig. 1.

Distribution.—San Pedro and Alamitos Bay, California.

PLATE I.

- FIG. 1. *Pandalopsis aleutica*.
♀, $\times \frac{1}{3}$. Albatross station 3480.
2. *Pandalopsis dispar*.
♀, $\times \frac{1}{3}$. Albatross station 3675.
3. *Pandalus goniurus*.
♀, nat. size. Albatross station 3293.



DECAPOD CRUSTACEANS.

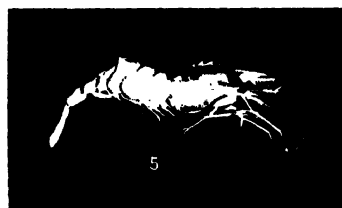
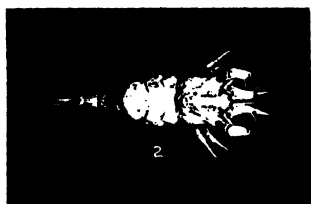
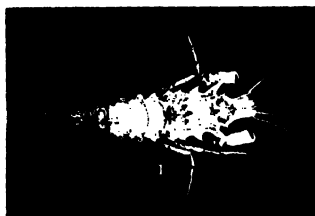
PLATE II.

- FIG. 1. *Pugettia dalli*.
 ♀, $\times 1\frac{1}{2}$. Southern California.
- 1a. *Pugettia dalli*.
 ♂, $\times 1\frac{1}{2}$. Southern California.
2. *Pandalus montagui tridens*.
 ♀, $\times \frac{3}{8}$. Albatross station 2842.
3. *Pandalus jordani*.
 ♀, $\times \frac{3}{8}$. Albatross station 2949.
4. *Pandalus stenolepis*.
 ♀, $\times \frac{3}{8}$. Albatross station 3464.
5. *Pandalus hypsinotus*.
 ♂, $\times \frac{3}{8}$. Herendeen Bay, Alaska.
6. *Pandalus gurneyi*.
 ♀, $\times 1\frac{9}{10}$. Albatross station 3130.



PLATE III.

- FIG. 1.** *Sclerocrangon sharpi*.
♂, dorsal view, nat. size. *Albatross* station 2842.
- 1a.** *Sclerocrangon sharpi*.
♂, profile. nat. size. *Albatross* station 2842.
- 2.** *Sclerocrangon alata*.
♂, dorsal view, nat. size. *Albatross* station 2865.
- 3.** *Spirontocaris gaimardii belcheri*.
♂, nat. size. *Albatross* station 3519.
- 3a.** *Spirontocaris gaimardii belcheri*.
♀, nat. size. *Albatross* station 3519.
- 4.** *Spirontocaris arcuata*.
♀, nat. size. *Albatross* station 2864.
- 5.** *Spirontocaris spina*.
♀, nat. size. *Albatross* station 2842.
- 6.** *Spirontocaris murdochi*.
♀, nat. size. *Albatross* station 3650.



DECAPOD CRUSTACEA

PLATE IV.

- FIG. 1. *Pagurus dalli*.
♂, $\times 1\frac{1}{2}$. Albatross station 3233.
2. *Pagurus rathbuni*.
♂, $\times \frac{3}{4}$. Albatross station 3519 (chelæ foreshortened).
3. *Pagurus capillatus*.
♂, $\times \frac{3}{4}$. St. Michael, Alaska.
4. *Pagurus brandti*.
♂, $\times \frac{3}{4}$. Albatross station 2847.
5. *Pagurus townsendi*.
♂, $\times \frac{3}{4}$. Albatross station 3502 (chelæ foreshortened).
6. *Pagurus undosus*.
♂, $\times 1\frac{3}{4}$. Albatross station 3638.
7. *Pagurus tanneri*.
♂, $\times \frac{3}{4}$. Albatross station 3016 (chelæ foreshortened).
8. *Pagurus confragosus*.
♂, $\times \frac{3}{4}$. Cat. No. 19,228 (chelæ foreshortened).



PLATE V.

- FIG. 1. *Pagurus setosus*.
 δ , $\times \frac{9}{16}$. Albatross station 3449.
2. *Pagurus munitus*.
 φ , $\times \frac{3}{8}$. Albatross station 2843.
3. *Pagurus cornutus*.
 φ , $\times \frac{3}{8}$. Albatross station 3608.
4. *Pagurus kennerlyi*.
 δ , in sponge (*Suberites*), $\times \frac{3}{8}$. Albatross station 3265.
5. *Pagurus beringanus*.
 δ , $\times \frac{9}{16}$. Albatross station 3234.
6. *Parapagurus mertensii*.
 δ , $\times \frac{9}{16}$. Albatross station 2948 (larger chela foreshortened).
7. *Pagurus samuelis*.
 δ , $\times \frac{9}{16}$. Pacific Grove.
8. *Pagurus granosimanus*.
 δ , $\times \frac{9}{16}$. Pacific Grove.
9. *Pagurus hemphillii*.
 δ , $\times \frac{9}{16}$. Monterey (chelæ foreshortened).
10. *Pagurus gilli*.
 δ , $\times \frac{3}{8}$. Dutch Harbor.

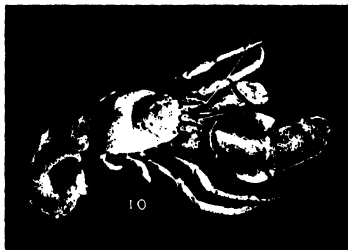


PLATE VI.

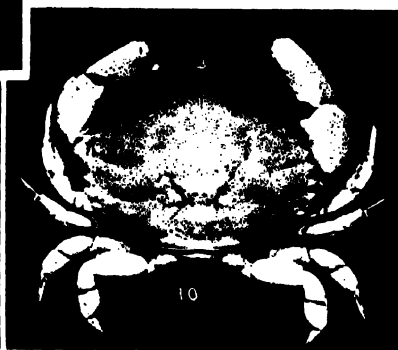
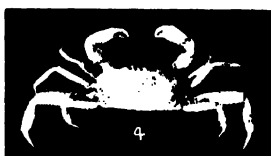
- FIG. 1. *Placetron wosnessenskii*.
♀. Type of *Lepeopus forcipatus*, $\times \frac{7}{10}$.
2. *Cancer anthonyi*.
♂, $\times \frac{7}{10}$. Playa Maria Bay.
3. *Cancer amphiatrus*.
♂, nat. size. Albatross station 3656.
4. *Cancer jordani*.
♀, nat. size. Monterey Bay.
5. *Oregonia bifurca*.
♀, type, $\times \frac{7}{10}$.
6. *Pachycheles rudis*.
♂, nat. size. Pacific Grove.



DECAPOD CRUSTACEANS

PLATE VII.

- FIG. 1. *Cancer oregonensis*.
 δ , nat. size. Albatross station 3274.
2. *Pilumnus spinohirsutus*.
 \varnothing , nat. size. Albatross station 3026.
3. *Pinnixa californiensis*.
 \varnothing , nat. size. Albatross station 3133.
4. *Pinnixa occidentalis*.
 δ , nat. size. Albatross station 2862.
5. *Scleroplax granulata*.
 \varnothing , $\times 1\frac{3}{4}$. Ensenada.
6. *Cryptophrys concharum*.
 δ , $\times 1\frac{3}{4}$. Neah Bay, Washington.
7. *Lophopanopeus lockingtoni*.
 \varnothing , nat. size. Albatross station 3591.
8. *Lophopanopeus frontalis*.
 δ , nat. size. Southern California.
9. *Lophopanopeus heathii*.
 δ , nat. size. Monterey Bay.
10. *Cycloxanthops novemdentatus*.
 δ , nat. size. Guadalupe Island.

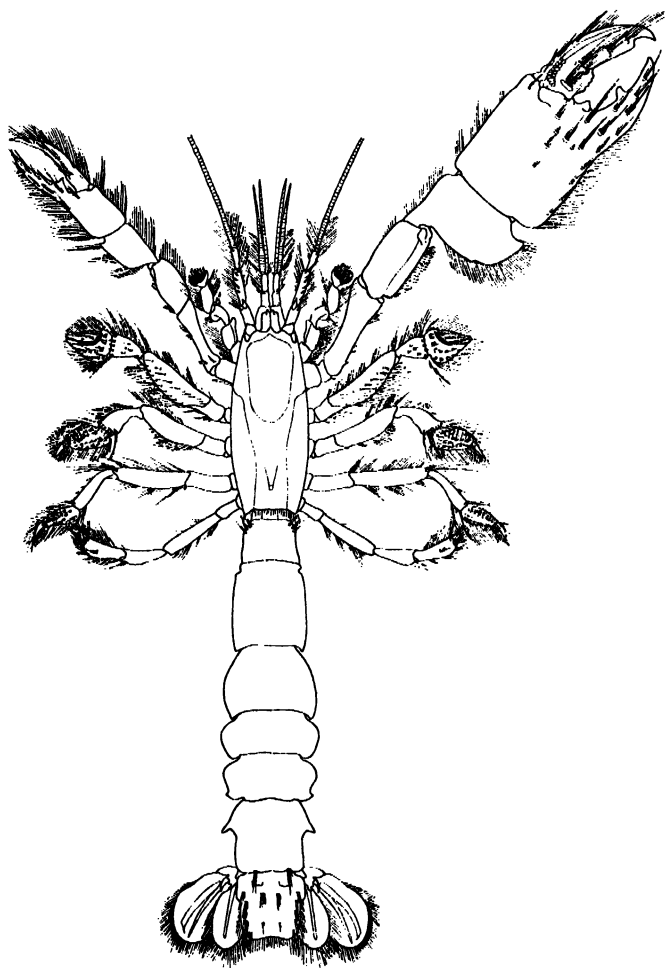


DECAPOD CRUSTACEAN

PLATE VIII.

Callianassa goniophthalma.

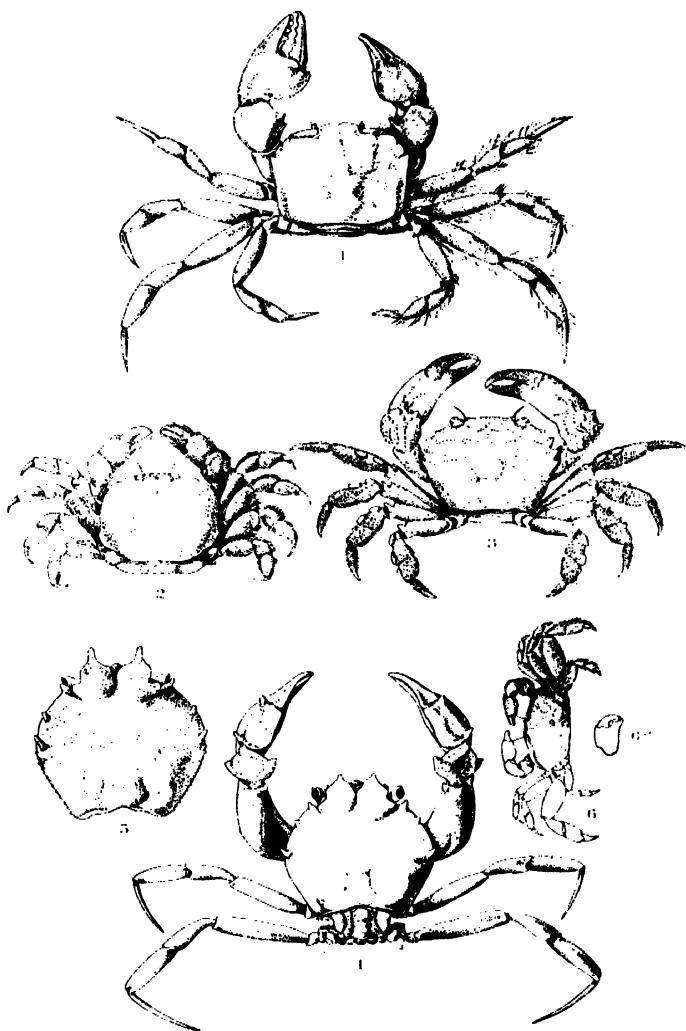
♂, nat. size. *Albatross* station 3198.



DECAPODS

PLATE IX.

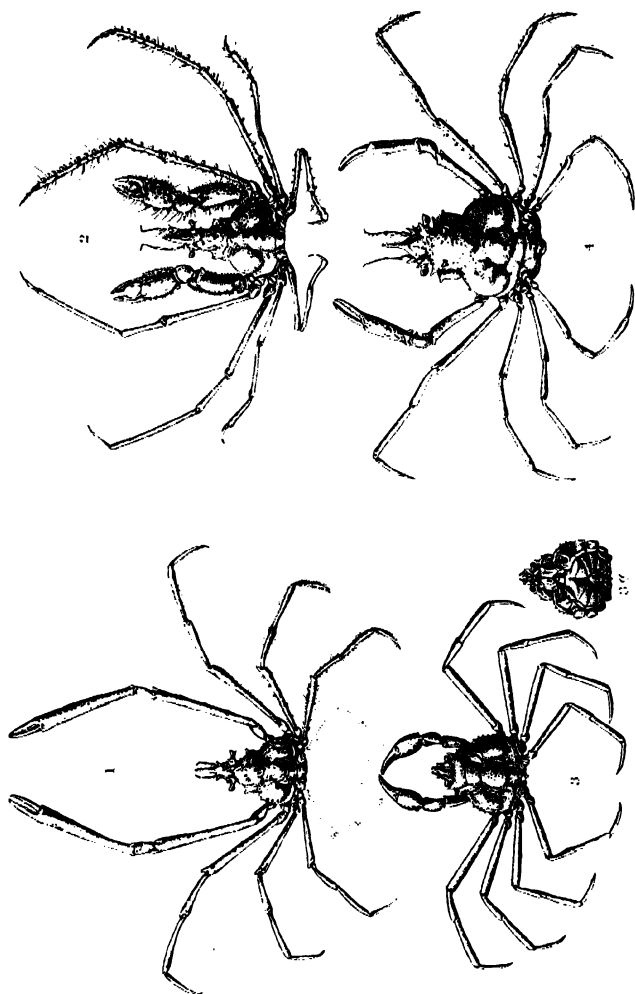
- FIG. 1. *Speocarcinus californiensis*.
♂, $\times 1\frac{1}{2}$. Alamitos Bay.
2. *Opisthepus transversus*.
♀, $\times 1\frac{1}{2}$. Pacific Grove.
3. *Lophopanopeus diegensis*.
♂, type, $\times 1\frac{1}{2}$.
4. *Clythrocerus planus*.
♂, $\times 6$. Southern California.
5. *Clythrocerus*, sp.
Carapace of ♂, $\times 6$. Catalina Island.
6. *Pinnixa occidentalis*.
♂, $\times 1\frac{1}{2}$. Wrangell.
- 6a. *Pinnixa occidentalis*.
Chela of ♂, $\times 1\frac{1}{2}$. Wrangell.



DECAPODS

PLATE X.

- FIG. 1.** *Erileptus spinosus*.
♂, $\times 2\frac{1}{4}$. Albatross station 2934.
- 2.** *Podochela hemphillii*.
♂, $\times \frac{5}{8}$. Albatross station 2831.
- 3.** *Dasygyius tuberculatus*.
♂, nat. size. Albatross station 3030.
- 3a.** *Dasygyius tuberculatus*.
♂, ventral view, nat. size. Albatross station 3030.
- 4.** *Anasimus rostratus*.
♀, $\times 3\frac{1}{4}$. Albatross station 2983.



DECAPODS

**ISOPOD CRUSTACEANS
OF THE NORTHWEST COAST OF
NORTH AMERICA**



ISOPOD CRUSTACEANS OF THE NORTHWEST COAST OF NORTH AMERICA

BY HARRIET RICHARDSON

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Systematic discussion of species	213
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THE present paper contains a list of the Isopods collected by the Harriman Alaska Expedition, and in addition a number of species from California received from Dr. William E. Ritter, head of the Zoological Department of the University of California.¹ Five species are described as new. A little-known species, *Idotea gracillima* (Dana) is figured for the first time and described more fully than heretofore; and *Asellus tomalensis* Harford also is redescribed and figured.

FLABELLIFERA or CYMOTHOIDEA.

Family CIROLANIDÆ.

CIROLANA HARFORDI (Lockington).

Ega harfordi LOCKINGTON, Proc. Calif. Acad. Sci., VII, Pt. I, p. 46, 1877.

Cirolana californica HANSEN, Vidensk. Selsk. Skr., 6th ser., natur. og math. Afd., V, pp. 338, 339, pl. III, fig. 2, 2f, 1890.

Cirolana harfordi RICHARDSON, Proc. U. S. Nat. Mus., XXI, pp. 822, 823, 1899.

Locality.—Wilson Cove, California (Dr. Ritter and party).

¹ Science, XV, No. 367, Jan. 10, pp. 55-65, 1902.

Family *ÆGIDÆ*.

ROCINELA BELLICEPS (Stimpson).

Æga belliceps STIMPSON, Proc. Acad. Nat. Sci. Phila., XVI, p. 155, 1864.
Æga alaskensis LOCKINGTON, Proc. Calif. Acad. Sci., VII, Pt. 1, p. 46, 1877.
Rocinela alaskensis RICHARDSON, Proc. Am. Phil. Soc., XXXVII, p. 11, 1898.
Rocinela belliceps RICHARDSON, Proc. U. S. Nat. Mus., XXI, p. 827, 1899.

Locality.—Yakutat, Alaska (Harriman Alaska Expedition).

Family *CYMOTHOIDÆ*.

LIVONECA VULGARIS Stimpson.

Livoneca vulgaris STIMPSON, Bost. Jour. Nat. Hist., VI, p. 508, pl. XXII, fig. 9, 1857; Proc. Bost. Soc. Nat. Hist., VI, pp. 88, 89, 1859.—SCHIEDTE and MEINERT, Naturhistorisk Tidsskrift, XIV, pp. 344–349, pl. XIV, figs. 1, 2, 1883–84.—RICHARDSON, Proc. U. S. Nat. Mus., XXI, p. 830, 1899.

Locality.—San Francisco Bay (Dr. Ritter and party).

Family *SPHÆROMIDÆ*.

DYNAMENE TUBERCULOSA Richardson.

Dynamene tuberculosa RICHARDSON, Proc. U. S. Nat. Mus., XXI, p. 833, 1899.

Locality.—Bodega Bay, California (Dr. Ritter and party).

SPHÆROMA OREGONENSIS Dana.

Sphæroma oregonensis DANA, Proc. Acad. Nat. Sci. Phila., VII, p. 177, 1854–55; U. S. Expl. Exp., Crust., Pt. II, XIV, p. 778, pl. LII, fig. 4, 1853.—STIMPSON, Bost. Jour. Nat. Hist., VI, p. 509, 1857.—RICHARDSON, Proc. U. S. Nat. Mus., XXI, p. 836, 1899.

Localities.—Popof Island (from fresh water), Yakutat, and Glacier Bay, Alaska; Grenville Channel and Lowe Inlet, British Columbia (Harriman Alaska Expedition).

SPHÆROMA PENTODON sp. nov.

Type from Sausalito, California.

Body elliptical in outline; color dark brown; surface minutely but densely granular.

Head situated transversely, with a prominent ridge on the anterior margin. Eyes placed post-laterally, and composed of many ocelli. First pair of antennæ extend to the posterior margin of the head; flagellum eight-jointed. Second pair of antennæ reach the middle of the second thoracic segment; flagellum composed of fifteen joints.

Segments of the thorax about equal in length, with the exception of the first, which is somewhat longer than any of those following. The

lateral parts, which are not distinctly separated from the dorsal parts of the segments, are drawn out in acute processes in the first three segments. Those of the following segments are more nearly regular in outline.

The abdomen is somewhat broader than the thorax, although this expansion of the abdomen does not show in a dorsal view. The first segment is about equal in length to the last thoracic segment, and is marked on either side by two suture lines indicative of coalesced segments. The terminal segment is entire, and not produced, being evenly rounded in outline. The anterior portion of the segment is convex, with a longitudinal series of four small tubercles on either side of the median line, the two series being close together. The posterior extremity of the segment is marked by a prominent transverse elevation.

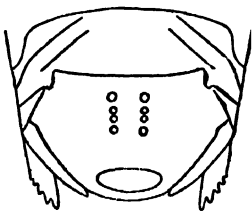


FIG. 96. Abdomen of *Sphaeroma pentodon* sp. nov. ($\times 8$).

The inner immovable branch of the uropoda is narrow, elongate, and pointed posteriorly; it extends to the extremity of the abdomen. The outer mobile branch is provided on its lateral margin with five strong teeth. Both branches are of equal length.

The first three pairs of legs are slender, and are furnished with long hairs. The other four pairs are somewhat stouter.

Ten specimens were collected at Sausalito, California, by Dr. Ritter and party.

This species is perhaps more closely allied to *Sphaeroma sieboldii* Dollfus¹ from Japan than it is to any of the known species of the genus from the Pacific coast of North America. It differs, however, from that species in having a prominent transverse elevation on the posterior portion of the terminal segment, while in *S. sieboldii* the posterior part of the segment is distinctly concave; in having five teeth on the lateral margin of the outer uropod, while in *S. sieboldii* there are seven; in having fifteen joints to the flagellum of the second pair of antennæ, while this organ in *S. sieboldii* has a flagellum composed of only ten joints; in having two longitudinal series of four small tubercles, one on either side of the median line on the terminal abdominal segment, while in *S. sieboldii* the granulations on the caudal segment form, in the middle, two divergent lines; and in having the body covered with minute granulations, while in *S. sieboldii* the granulations are strong and more prominent.

The type is in the Museum of the University of California. The copy is in the U. S. National Museum, Cat. No. 28,768.

¹ Notes from the Leyden Museum, XI, pp. 93, 94, pl. 5, 1889.

VALVIFERA or IDOTEIDEA.

Family IDOTEIDÆ.

CHIRIDOTEA ENTOMON (Linnaeus).

Oniscus entomon LINNÆUS, Syst. Nat., 12th ed., II, p. 1060, 1766.—PALLAS, Spicil. Zool., IX, p. 64, pl. v, figs. 1-6, 1772.

(?) *Entomon pyramidale* KLEIN, Rem. sur les Crustacés, figs. 1-3.

Squilla entomon DE GEER, Mém. pour servir à l'Hist. des Insectes, VII, p. 514, pl. XXXII, figs. 1-10, 1778.

Asellus entomon OLIVIER, Encycl. Méth., p. 253, 1789.

(?) *Cymothoa entomon* FABRICIUS, Ent. Syst., II, p. 505, 1793.

Idotea entomon BOSC, Hist. Nat. des Crust., II, p. 178, 1802.—LATREILLE, Hist. Nat. Crust. et Ins., VI, p. 361, 1803-4; VII, pl. LVIII, figs. 2, 3.—

(?) LAMARCK, Hist. des Anim. sans Vert., 1st ed., V, p. 159, 1818.—

(?) DESMAREST, Consid. Crust., p. 289, 1825.—RATHKE, Neuste Schriften

der naturf. Gesellsch. in Danzig, I, p. 109, pl. IV, 1820.—KRÖYER, Vid.

Selsk. Skrift., VII, p. 323, 1838.—MILNE EDWARDS, Hist. Nat. Crust., III,

p. 128, 1840.—KRÖYER, Nat. Tidsskr., II, p. 402, 1847.—WHITE, List

Cr. Brit. Mus., p. 93, 1847.—BRANDT, Cr. in Middendorff's Sibirische

Reise, II, Pt. I, p. 145, 1851.—MEINERT, Nat. Tidsskr., 3d ser., XI, p. 84,

1877.—BRANDT, Comptes Rendus, p. 713, 1880; Ann. Mag. Nat. Hist.,

VI, p. 98, 1880.

(?) *Saduria entomon* ADAMS, in White, Sunderland's Voyage Baffin's Bay, etc., Appendix, p. ccvii, 1852.

Idoteya longicauda LOCKINGTON, Proc. Calif. Acad. Sci., VII, Pt. I, p. 45, 1877.

Glyptonotus entomon MIERS, Trans. Linn. Soc. London, XVI, pp. 12, 13, pl. I, figs. 1, 2, 1883. (See MIERS for above synonymy.)—RICHARDSON,

Proc. U. S. Nat. Mus., XXI, p. 843, 1899.

Localities.—St. Michael, Alaska (Dr. Ritter); Yakutat Bay, Alaska (Harriman Alaska Expedition).

IDOTEA RESECATA Stimpson.

Idotea resecata STIMPSON, Bost. Jour. Nat. Hist., VI, pp. 504, 505, pl. XXII, fig. 7, 1857; Proc. Bost. Soc. Nat. Hist., VI, p. 88, 1859.—MIERS,

Jour. Linn. Soc. London, XVI, pp. 45, 46, 1883.—RICHARDSON, Proc.

U. S. Nat. Mus., XXI, p. 844, 1899.

Locality.—Tomaes Bay, California (Dr. Ritter and party).

IDOTEA GRACILLIMA (Dana).

Stenosoma gracillimum DANA, Proc. Acad. Nat. Sci. Phila., VII, p. 175.—STIMPSON, Bost. Jour. Nat. Hist., VI, p. 505, 1857.

Idotea gracillima MIERS, Jour. Linn. Soc. London, XVI, p. 35, 1883.—RICHARDSON, Proc. U. S. Nat. Mus., XXI, p. 844, 1899.

Locality.—California (Dana).

The description of this species given by Professor Dana is very short and rather vague. He describes the body as extremely slender and

filiform, the thoracic segments subquadrate, head quadrate. He refers to the linear post-abdomen, which is truncated at the apex, three-jointed, and marked on either side with a suture. The antennæ are described as being a little shorter than half the body, with a ten- to twelve-jointed flagellum.

No figure of the form has ever been given.

A species of *Idotea* was sent to the U. S. National Museum by Dr. Ritter. The specimens, which are eight in number, were collected by him at Bolinas, California. They are more closely allied to *I. gracillima* than to any other known species of *Idotea* from the Pacific coast of North America. Until evidence can be given of their distinctness, I shall consider them identical with *I. gracillima* (Dana).

Body slender, about seven times longer than wide,¹ with the sides nearly parallel. Surface entirely smooth. Color in alcohol uniformly pinkish. A note referring to the color of the specimens in life states that they are green, brown, and striped.

Head quadrate, with rounded antero-lateral margins, and a slight median excavation in the anterior margin. Eyes situated at the extreme lateral edge and about the middle of the head; they are small but distinct. The first pair of antennæ are four-jointed, and extend a little beyond the extremity of the second peduncular joint of the second pair of antennæ. The second pair of antennæ are equal to half the length of the body; the last two joints of the peduncle are subequal; in the smaller specimens the flagellum is composed of ten joints; in the larger ones there are eighteen joints.

The first thoracic segment is short in the middle but is produced antero-laterally on either side; it is not wider than the head. The second, third, and fourth segments are subequal in length and are longer than the first segment. The fifth, sixth, and seventh segments gradually decrease in length. The epimera of all the segments are extremely narrow; those of the second and third segments extend but half the length of the segment; those of the fourth and fifth segments extend three fourths the length of the segment; those of the last two segments extend the entire length of the segment.

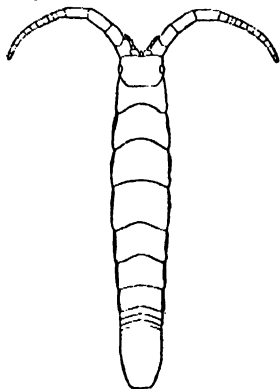


FIG. 97. *Idotea gracillima* (Dana) ($\times 5$).

¹ The female is figured. The body is somewhat broader than in the male.

The abdomen consists of three distinct segments, with suture lines on either side of another partly coalesced segment. The third or terminal

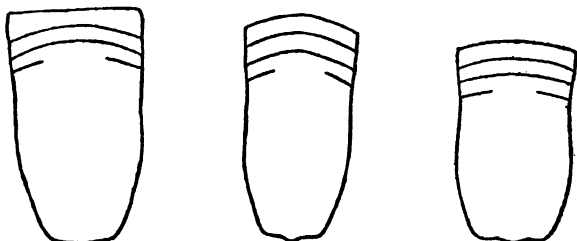


FIG. 98. *Idotea gracillima* (Dana). Abdomen, showing variations in form.

segment has subparallel sides to about the middle, where the segment gradually becomes narrower to a truncate extremity. On the posterior margin of the terminal segment is a faint indication of a double emargination on either side of an obtuse median point.

Legs small and slender and devoid of hairs.

The five small specimens and one large one agree in having the terminal segment as described above. The two larger specimens show the emargination more distinctly, one of the specimens more so than the other.

Figures showing all three variations are given.

The specimens agree in all other characters.

Dana's specimens were collected by Professor J. Le Conte on the coast of California.

IDOTEA WOSNESENSKII Brandt.

Idotea wosnesenskii BRANDT, Middendorff's Sibirische Reise, II, Pt. 1, Crust., p. 146, 1851.

Idotea hirtipes DANA, U. S. Expl. Exp., Crust., XIV, Pt. II, p. 704, pl. XLVI, fig. 6, 1853.

Idotea oregonensis DANA, Proc. Acad. Nat. Sci. Phila., VII, p. 175, 1854.

Idotea wosnesenskii STIMPSON, Bost. Jour. Nat. Hist., VI, p. 504, 1857.

Idotea wosnesenskii SPENCE BATE, Lord's Naturalist in British Columbia, II, p. 281, 1866.—MIERS, Jour. Linn. Soc. London, XVI, p. 40, 1883.—RICHARDSON, Proc. U. S. Nat. Mus., XXI, p. 846, 1899.

Localities.—Dutch Harbor on Unalaska Island; Humboldt Bay on Popof Island; Yakutat; Glacier Bay; Garforth Island in Muir Inlet, and Sitka, Alaska (Harriman Expedition). Beaver Cove on Vancouver Island (Harriman Expedition). Lands End, Calif. (Dr. Ritter and party).

IDOTEA STENOPS Benedict.

Idotea stenops BENEDICT, Proc. Biol. Soc. Wash., XII, pp. 54, 55, 1898.—
RICHARDSON, Proc. U. S. Nat. Mus., XXI, p. 846, 1899.

Locality not given (Dr. Ritter and party).

IDOTEA OCHOTENSIS Brandt.

Idotea ochotensis BRANDT, Middendorff's Sibirische Reise, II, Pt. 1, Crust., p. 145, pl. VI, fig. 33, 1851.—MIERS, Jour. Linn. Soc. London, XVI, pp. 32-34, pl. I, figs. 8-10, 1883.—RICHARDSON, Proc. U. S. Nat. Mus., XXI, p. 846, 1899.

Localities.—Lands End and Fort Point, California (Dr. Ritter and party). Humboldt Bay on Popof Island, Alaska (Harriman Alaska Expedition).

SYNIDOTEA RITTERI sp. nov.

Type from Lands End, San Francisco, Calif.

Body ovate in outline. Color yellow, with markings of black; terminal segment almost entirely black.

Head with prominent rounded antero-lateral angulations, at base of which, and just above the eyes, is a conspicuous horn-like projection, hook-shaped, directed upward and forward, one on either side of the head. In the median excavation of the frontal margin on either side of the median line is a prominent tubercle. Between the eyes and in line with them on the posterior portion of the head are two low tubercles. The eyes are situated at the extreme lateral margins on the posterior portion of the head, and are somewhat elevated above the surface; they are black and conspicuous, and composed of many ocelli. The first pair of antennæ consist of four joints, the last joint clavate and fringed with hairs. The second pair of antennæ have a five-jointed peduncle and a flagellum composed of eight joints; the third joint of the peduncle has a prominent tubercle.

The first four segments of the thorax are longer than the last three. The lateral parts of all the segments are widely expanded, with margins well rounded. The lateral parts are not separated from the dorsal portion of the segments, but are firmly anchylosed.



FIG. 99. a. Head of *Synidotea ritteri* sp. nov. ($\times 14$).
b. Head of *Synidotea consolidata* (Stimpson) ($\times 14$).

The abdomen consists of one segment, with suture marks, one on either side, indicative of another partly coalesced segment. The abdo-

men tapers gradually to a broadly rounded extremity, which is slightly excavate in the median line.

The seven pairs of legs are but sparingly furnished with hairs. The upper half of the opercular valve is black, the lower half yellow.

There are three longitudinal lines of low swellings on the body, one median, the other two placed one on either side of the median line.

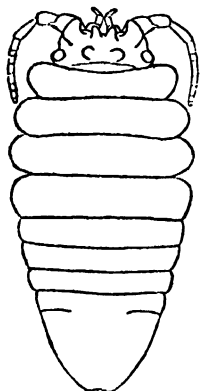


FIG. 100. *Synidotea ritteri* sp. nov. ($\times 10$).

Only one specimen was taken at Lands End, California, by Dr. Ritter and party.

This species is closely allied to *Synidotea consolidata* (Stimpson),¹ but differs from that species in the shape and greater size of the tubercles in front of the eyes, the tubercles being hook-shaped and very prominent in *S. ritteri* and projecting far in front of the anterior margin of the head, while in *S. consolidata* they are small (Stimpson speaks of them as being minute), are not hooked, and do not project any considerable distance in front of the anterior margin of the head; in the greater size of the two median tubercles on the anterior division of the head (Stimpson does not mention these tubercles in his description, but in the specimens sent to the U. S. National Museum from Pacific Grove, California, by Mr. J.

O. Snyder, and which Dr. James E. Benedict has identified with *S. consolidata* and figured in his paper on the genus *Synidotea*,² these tubercles are present, but very minute); in the shape of the terminal segment of the body, it being much broader, and tapering very gradually to a broadly rounded extremity, which has a slight median notch or excavation in *S. ritteri*, while in *S. consolidata* the terminal segment of the body is narrower and tapers to an extremity marked by two pronounced teeth or angulations separated by a deep median notch.



FIG. 101. a. Abdomen of *Synidotea ritteri* sp. nov. ($\times 14$).
b. Abdomen of *Synidotea consolidata* (Stimpson) ($\times 14$).

Specimens of the same size were taken in making the above comparisons.

¹ Proc. Calif. Acad. Sci., I, p. 97, 1856; Bost. Jour. Nat. Hist., VI, p. 503, 1857.

² Proc. Acad. Nat. Sci. Phila., p. 393, 1897.

ASELLOTA or ASELLOIDEA.

Family JANIRIDÆ.

JANIROPSIS KINCAIDI sp. nov.

Type from Yakutat Bay, Alaska.

Color of body light brown, profusely and densely covered with black markings.

Head wider than long; frontal margin nearly straight, with lateral angles rounded. Eyes large, black, situated some little distance from the lateral margin. First pair of antennæ short; flagellum consisting of only eight joints in the female, of ten in the male. Second pair of antennæ lost in all the specimens. Maxillipeds with palp consisting of five joints, the first three of which are very much dilated.

First segment of thorax with lateral margins straight; epimera rather bilobed, and occupying most of the lateral margin of the segment. Second, third, fourth, and fifth segments with antero-lateral angles produced into rounded lobes. Epimera of second and third segments situated about the middle of the lateral margin; those of the fourth and fifth segments occupying more of a posterior position on the lateral margin. Epimera of the last two segments situated at the post-lateral angles of the segments.

Abdomen broad, gradually becoming somewhat narrower toward the posterior extremity. Posterior margin produced in three lobes, two lateral lobes, one on either side of a broadly rounded median lobe; the two lateral

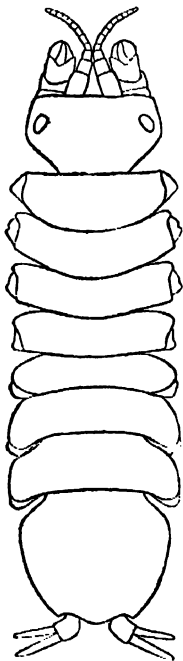


FIG. 102. *Janiroopsis kincaidi* sp. nov. ($\times 27$).



FIG. 103. Maxilliped ($\times 77$).

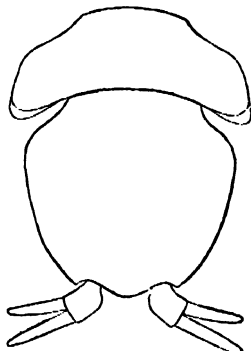


FIG. 104. Last thoracic segment, abdomen, and uropoda ($\times 41$).

lobes are acute. The uropoda are short, not longer than half the length of the terminal segment of the body; the basal segment is broad, quadrate in shape, and shorter than either branch; the inner branch is somewhat longer than the outer one. The middle piece of the operculum in the male is very similar to the figure given by Sars¹ of the type species of the genus, *Janiropsis breviremus*. It is produced and greatly dilated at the distal extremity.



Uropod
($\times 77$).

Nine specimens were obtained by the Harriman Expedition at Yakutat, Alaska. They were collected by T. Kincaid, after whom the species is named. Five females and four males were collected. The legs of the first pair in the male are not greatly longer than the others; they are longer in the type species of *Janiropsis*.

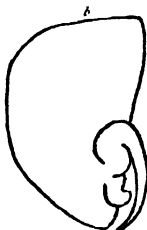
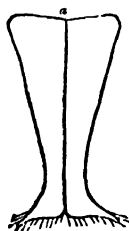
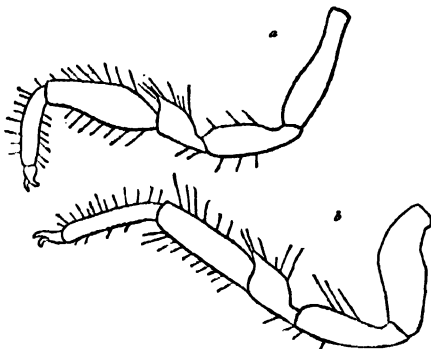


FIG. 106. a. Middle piece of male operculum. b. Lateral plate of male operculum. c. Second pleopod of male. (All $\times 55$).

The very short superior antennæ with few articulations, the greatly dilated joints of the maxillipeds, the form and shape of the middle piece of the male operculum, with its dilated tip, and the shortness of the uropoda, which are only half the length of the terminal segment of the body, are characters which undoubtedly place this species with *Janiropsis* Sars.



Type in the U. S. Nat. Museum, Cat. No. 28,717. FIG. 107. a. Leg of first pair ($\times 41$). b. Leg of second pair ($\times 41$).

¹ Crustacea of Norway, II, p. 102, 1899.

JANIROPSIS CALIFORNICA sp. nov.

Type from Sausalito, California.

Body narrow, elongate; surface smooth; color uniformly whitish.

Head with a prominent rounded median lobe on the anterior margin; lateral angulations rounded; lateral margins straight and converging toward the base. Eyes black, distinct, but small and simple in structure. First pair of antennæ are composed of six joints and extend nearly to the middle of the fifth joint of the peduncle of the second pair of antennæ. Second pair of antennæ are about equal to one third the length of the body; the flagellum is composed of nineteen or twenty joints.

The first thoracic segment is but little wider than the head; the margins are entire, lateral lobes rounded. The second segment has the lateral margin straight, with the epimeron showing slightly along the edge. The third and fourth segments have the antero-lateral lobe rounded,

the posterior margin straight, with the epimeron showing as a rounded lobe. The fifth, sixth, and seventh segments have rounded lateral margins, with epimera showing on the posterior part of the segments.

Terminal segment rounded posteriorly with smooth margins, and a median lobe between the uropoda.

Uropoda very short, about half as long as the terminal segment. Branches about equal in length and twice as long as the peduncle.

Legs simple, ambulatory, similar in shape and size and bi-unguiculate.

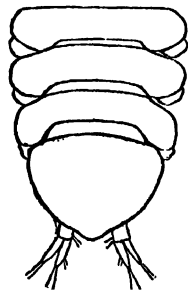


FIG. 109. *Janiropsis californica* sp. nov. Terminal part of body ($\times 41$).

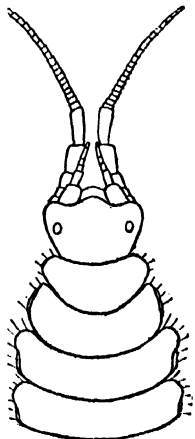


FIG. 108. *Janiropsis californica* sp. nov. Anterior part of body ($\times 41$).

Only two good specimens, both females, were taken at Sausalito, California, by Dr. Ritter and party. Two imperfect specimens also are from the same locality.

Until now the only other known species of this genus was *Janiropsis breviremus* Sars.¹ As that author has pointed out, this genus differs from *Janira*, to which it is very closely related, in the much shorter uropoda;

¹ Crustacea of Norway, II, p. 98, 1899.

in the shorter second pair of antennæ; in the structure of the first pair of antennæ, which have the flagellum composed of only a restricted number of articulations; in the structure of the first pair of legs in the male, these being "remarkably developed, prehensile, much longer than any of the other pairs, with the carpal joint fusiformly dilated"; in the female, however, this pair does not differ from the other legs, all being ambulatory in character.

JANIRA OCCIDENTALIS Walker.

Janira occidentalis WALKER, Trans. Liverpool Biol. Soc., XII, pp. 280, 281, pl. XV, figs. 7-10, 1898.—RICHARDSON, Proc. U. S. Nat. Mus., XXI, p. 859, 1899.

Locality.—Puget Sound (Harriman Alaska Expedition).

Family ASELLIDÆ.

ASELLUS TOMALENSIS Harford.

Asellus tomalensis HARFORD, Proc. Calif. Acad. Sci., VII, pp. 54, 55, 1877.

Locality.—Tomaes Bay, California (Harford).

The description of this form is given in the following concise manner: "Head a little transverse, narrower than the body. Upper antenna not reaching to the extremity of the peduncle of the lower. Flagellum of lower antennæ longer than its peduncle. Body narrow in front, gradually increasing in width towards the tail. Peduncle of caudal appendages more than half the length of the terminal filaments. Length $\frac{3}{8}$ inch."

The description is from a single specimen.

Eight specimens of a species of *Asellus* were collected by the Harriman Alaska Expedition at Lake Washington, Seattle. I have referred them to the above species, being unwilling to describe a new species of *Asellus* from a locality so close to that from which *A. tomalensis* was found, when so little is known about *A. tomalensis*. Some of the specimens were sent to Dr. William E. Ritter for comparison with the type and only specimen of *A. tomalensis* in the collection of the California Academy of Sciences. The result of his comparison is given in the following quotation from his letter: "About the only difference that I am able to make out is in the fact that the inner ramus of the sixth pleopods (uropods?) of *A. tomalensis* is about half as long as the exopodite, and that neither is armed with a tuft of hairs at the tip. This is the case with the one appendage present, but its mate is gone. It is possible that the hair-tuft may have been broken off, but the tips of the rami themselves are perfectly smooth. They show no evidence of having lost anything. The fact, however,

that the general hairiness of the Academy specimen is about the same as that of your specimen makes me suspicious that the tuft referred to has been removed. The antennæ and antennules differ in no essential respect, so far as I can see. The chelipeds of the type specimen I am, unfortunately, unable to find."

Description.—Body narrow, elongate, gradually widening somewhat from the anterior to the posterior extremity.

Head but little narrower than the first thoracic segment and about twice as wide as long; frontal margin slightly excavate and without median

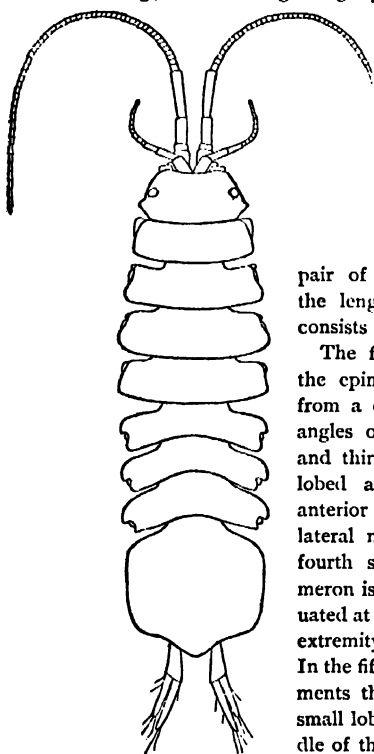


FIG. 110. *Asellus tomalensis*
Harford (X 14).

process between the antennæ; lateral margins straight, with a small lobe on either side near the base of the head. Eyes lateral, situated in the median transverse line. First pair of antennæ reach the extremity of the peduncle of the second pair of antennæ; flagellum contains about ten joints. Second pair of antennæ are about two thirds the length of the body; the flagellum consists of about 55 joints.

The first segment of the thorax has the epimeral lobes distinct and visible from a dorsal view at the antero-lateral angles of the segment. In the second and third segments the epimera are bilobed and occupy the anterior portion of the lateral margins. In the fourth segment the epimeron is a small lobe situated at the antero-lateral extremity of the segment. In the fifth and sixth segments the epimeron is a small lobe about the middle of the lateral margin. In the seventh segment



FIG. 111. Mandible
of *Asellus tomalensis*
Harford.

it has more of a posterior position on the lateral margin.

The abdomen is broad, with the sides nearly parallel. Posteriorly it is

produced in the center in a large triangularly shaped lobe with rounded apex. The uropoda are slender appendages; the peduncle is somewhat shorter than the branches. The inner branch is about a fifth longer than the outer branch. The margins of all the segments, the uropods, and the legs are fringed with hairs.



FIG. 112. Leg of first pair of *Ascellus tomalensis* Harford ($\times 28$).

The legs of the first pair are cheliform; the propodus is elliptical in outline, with the inferior margin straight. The other legs are similar and ambulatory in character.

The color of the species is a light brown, somewhat mottled.

Family *MUNNIDÆ*.

MUNNA sp.

A very much mutilated specimen of a species of *Munna* was taken by the Harriman Alaska Expedition at the Pribilof Islands. The Munnidæ have not heretofore had any representatives from the Pacific coast. Although it is very probable that the present specimen is the type of a new species, it is not, however, in a sufficiently complete condition to warrant a description.

ONISCOIDEA.

Family *LIGIIDÆ*.

LIGIA OCCIDENTALIS Dana.

Ligia occidentalis DANA, U. S. Expl. Exp., Crust., XIV, Pt. II, p. 742, pl. XLIX, fig. 7; Proc. Acad. Nat. Sci. Phila., VII, p. 176.—STIMPSON, Bost. Jour. Nat. Hist., VI, p. 506, 1857.—HARFORD, Proc. Calif. Acad. Sci., VII, p. 116, 1877.—BUDDE-LUND, Crust. Isop. Terrestria, p. 264, 1885.—RICHARDSON, Proc. U. S. Nat. Mus., XXI, p. 866, 1899.

Localities.—Sausalito, California, and San Bartolomé Bay, Lower California (Dr. Ritter and party).

LIGIA PALLASII Brandt.

Ligia pallasii BRANDT, Bull. Soc. Impér. des Natur. de Moscou, VI, p. 172, 1833.

Ligia dilatata STIMPSON, Bost. Jour. Nat. Hist., p. 507, pl. XXII, fig. 8, 1857.—S. I. SMITH, Rept. Prog. Geol. Survey Canada, 1878–79.

Ligia septentrionalis LOCKINGTON, Proc. Calif. Acad. Sci., VII, Pt. I, p. 46, 1877.

Ligia stimpsoni MIERS, Proc. Zool. Soc. London, p. 671 (see footnote), 1877. *Ligia pallasii* BUDDE-LUND, Crust. Isop. Terrestria, pp. 261, 262, 1885.

Locality.—Lowe Inlet, British Columbia (Harriman Alaska Expedition).

Family *TRICHONISCIDÆ*.*TRICHONISCUS PAPILLICORNIS* sp. nov.

Type from Seldovia, Cook Inlet, Alaska.

Body covered with low tubercles. Color light brown.

Head with sides produced at the antero-lateral angles in large lobes; front triangularly produced with a slight emargination at the apex of the triangle. Eyes situated on the lateral margins at the base of the antero-lateral lobes; they are small and black and apparently simple in structure. The peduncle of the antennæ consists of five stout joints, the last three of which have the inner margins beset with numerous strong tubercular-like papillæ, each sur-

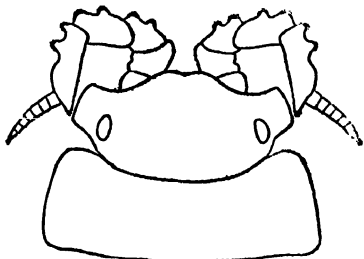


FIG. 113. Head and first thoracic segment of *Trichoniscus papillicornis* ($\times 41$).

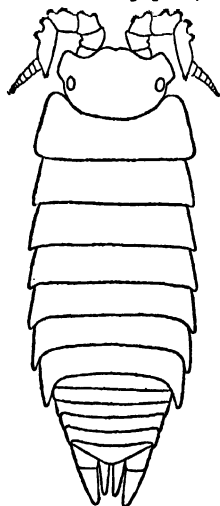


FIG. 114. *Trichoniscus papillicornis* sp. nov. ($\times 23$).

mounted with a tuft of short stiff hairs or bristles; the fifth joint is also produced at the outer distal angle in an acute process. The flagellum is composed of about seven joints, the joints being rather indistinctly defined; the last joint is tipped with a bunch of hairs. The buccal mass is very prominent below.

The segments of the thorax are about equal in length. The post-lateral angles of all the segments, except the first, are produced backward, very slightly in the case of the second, third, and fourth, but becoming gradually more so, until the last two segments show this character very markedly.

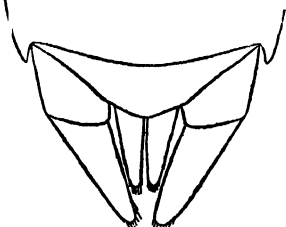


FIG. 115. Uropoda and last segment of abdomen ($\times 77$).

The abdomen is narrower than the thorax. All the segments are visible in entirety, not being covered laterally by the last thoracic seg-

ment. The terminal segment is triangularly produced, with the apex somewhat rounded. The uropoda are short, styliform; the outer branch is the stouter and extends a little beyond the extremity of the inner branch. Both branches are tipped with a few hairs.

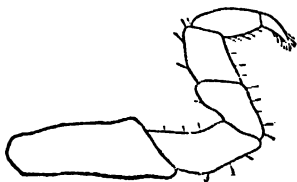


FIG. 116. Leg of first pair ($\times 23$).

Harriman Alaska Expedition. It was found on the beach at Seldovia, Cook Inlet.



FIG. 117. Uropod of left side ($\times 77$).

The type is in the U. S. National Museum, Cat. No. 28,772.

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**AMPHIPOD CRUSTACEANS
OF THE EXPEDITION**



AMPHIPOD CRUSTACEANS OF THE EXPEDITION

BY S. J. HOLMES

THE Amphipod crustaceans collected by the Harriman Alaska Expedition number twenty-two species. Six of these are here described for the first time. I am indebted to Prof. W. E. Ritter, Prof. Trevor Kincaid, and Dr. W. R. Coe for the specimens upon which this report is based.

Tribe *Hyperiidea*.

PARATHEMISTO OBLIVIA (Kröyer).

Three specimens collected at Humboldt Bay, Popof Island, Alaska.

Tribe *Gammaridea*.

Family *ORCHESTIDÆ*.

ALLORCHESTES OCHOTENSIS Brandt.

Eyes rather small, irregularly oval to broadly reniform. First antennæ nearly as long as the second, the second joint nearly as long as the first; third about three fifths as long as the second; flagellum about as long as the peduncle and composed of 15-20 short segments. Second antennæ a third the length of the body, the last two joints of the peduncle of sub-equal length; flagellum as long as the peduncle. Fourth joint of the palp of the maxillipeds narrow, curved, but scarcely unguiform. First gnathopods almost alike in the two sexes, the hand slightly narrower across the middle in the female. Second gnathopods in the male with the basal joint stout, much widened below, and concave anteriorly; carpus small and produced posteriorly into a narrow lobe which is commonly concealed between the merus and propodus; hand large, oblong,

with an oblique, slightly curved palm which is provided with a short stout spine at the posterior end. Second gnathopods of the female with the merus produced below into a narrow rounded setose lobe; the carpus relatively large, with a prominent, rather narrow setose lobe behind;

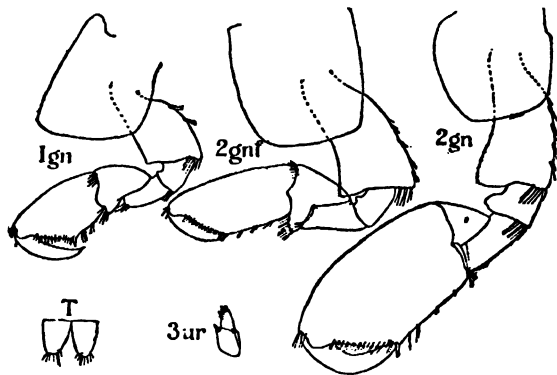


FIG. 118. *Allorchestes ochotensis*. 2gnf = second gnathopod of ♀; other figures from a ♂.

hand oblong, narrower than the carpus, relatively smaller and narrower than in the male, but otherwise quite similar; dactyl less strongly curved than in the male, and fitting closely to the palm. Posterior margin of the basal joints of the last three pairs of pereopods smooth. Peduncle of the first uropods nearly as long as the rami, and armed distally with a slender spine. Rami of the second uropods subequal, longer than the peduncle, the inner ramus rather broad at the base. Terminal uropods reaching about to the middle of the rami of the second pair, the ramus nearly as long as the very broad peduncle. Telson broad, cleft nearly to the base, the lobes armed distally with a pair of spines and several setae.

Length 20 mm.

Several specimens collected by Dr. W. R. Coe, at Dutch Harbor, Alaska. In the larger specimens the last two thoracic and first three abdominal segments are elevated posteriorly and terminate abruptly, giving the back almost the appearance of being dentate.

Family *LYSIANASSIDÆ*.

TRYPHOSA NUGAX sp. nov.

Type from St. Paul, Pribilof Islands, Alaska (a single specimen).

Body plump and compact. Eyes oval. Lateral angles of the head produced and rounded. Anterior pairs of coxal plates about twice as deep

as long; the fifth pair about as broad as deep. Postero-lateral angle of the third abdominal segment nearly a right angle, the posterior margin of the epimeral plate above the angle smooth and straight. Fourth abdominal segment but slightly concave dorsally. First joint of the first antennæ very thick and somewhat produced distally over the second joint; flagellum scarcely as long as the peduncle, and composed of six or seven joints, the first joint

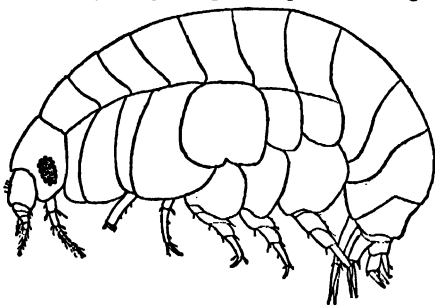


FIG. 119. *Tryphosa nuxax*.

but little longer than the succeeding one; secondary flagellum short and rather stout, consisting of four joints, of which the first is nearly as long as the three others. Second antennæ a little longer than the first pair; flagellum not so long as the peduncle. Molar tubercle of the mandibles situated about midway between the cutting edge and the insertion of the palp. Inner plate of the maxillipeds reaching nearly as far forward as the tip of the second joint of the palp, and armed distally with a few short teeth; outer plate reaching about to the middle of the third joint

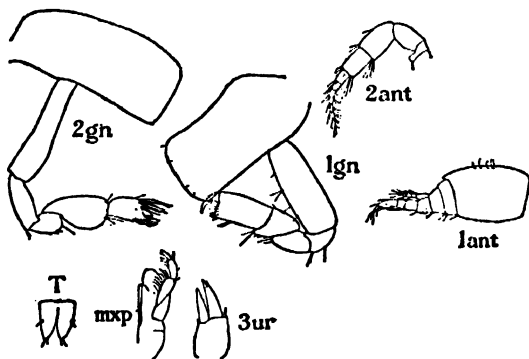


FIG. 120. *Tryphosa nuxax*.

of the palp, and armed distally and around the inner angle with several short teeth. First gnathopods with the hand rectangular, not tapering distally, the palm transverse, nearly straight, and armed posteriorly with

a pair of spines. Second gnathopods with the carpus broad and strongly bulging posteriorly; hand oblong, with the lower angle produced below the dactyl. The three posterior peræopods short, the basal joints very broad and nearly as long as the rest of the appendage, the posterior margin smooth and furnished with a few very short setæ. First pair of uropods with the rami shorter than the peduncle; rami of the second pair about equal to the peduncle; inner ramus of the terminal uropods devoid of spines or setæ and reaching the tip of the first joint of the outer ramus; outer ramus devoid of spines, with the exception of a few at the tip of the first joint. Telson longer than wide, cleft nearly to the base, the lobes diverging toward the tip, armed distally with a pair of spines, and a spine near the middle of the outer margin.

Length 3 mm.

This species may be distinguished from the other members of the genus by the short first joint of the flagellum of the first antennæ. The depression on the dorsal side of the fourth abdominal segment is much less deep than in most of the other species of *Tryphosa*.

Family STENOTHOIDÆ.

STENOTHOE ALASKENSIS sp. nov.

Type from St. Paul Island, Pribilof Islands, Alaska (one specimen, collected by Prof. Trevor Kincaid).

First antennæ about two thirds as long as the second; the first joint of the peduncle twice the length of the second; third joint scarcely half as long as the second; flagellum not as long as the peduncle and composed of about ten joints. Second antennæ not half as long as the body, the last joint of the elongated peduncle about the length of the preceding one; flagellum scarcely exceeding the last joint of the peduncle and composed of few segments, of which the first is nearly as long as all the others combined. Palp of the first maxillæ consisting of a single joint, the distal and inner margins of which are armed with short spines. Maxillipeds with the inner plates comparatively short and broad, the lobes armed distally with a pair of short spinules; outer plate represented by the projecting inner angle of the ischium; palp rather stout. First gnathopods with the merus produced and rounded at the lower end; carpus broad, the posterior margin somewhat projecting near the middle, where a pectinate spine and several strong setæ are inserted; lower posterior angle also armed with pectinate spines; hand twice as long as wide, much narrower than the carpus, tapering distally on both sides from near the middle; palm armed with short spinules; dactyl pectinate

on the inner margin with fine spinules and furnished with about five short setæ. Second gnathopods with the merus rounded below, the carpus broader than long, with a narrow, setose posterior lobe; hand large,

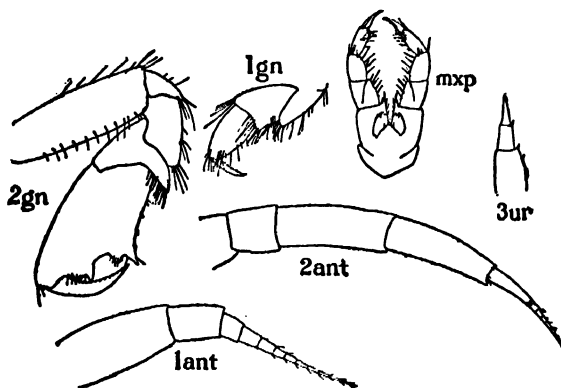


FIG. 121. *Stenothoe alaskensis*.

about as long as all the preceding joints, widening distally; palm oblique, terminated with a strong spine at the posterior end, deeply excavated in the middle and having a prominence on either side of the excavation. Coxal

plate of the first peræopods nearly three times as deep as wide and about twice as deep as its segment; coxal plates of the second peræopods very large and subtriangular. Postero-lateral angle of the third abdominal segment produced backward as a triangular lobe.

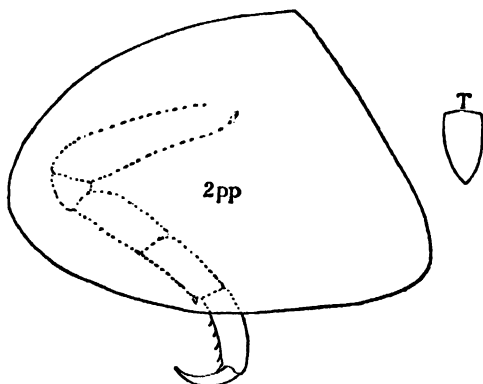


FIG. 122. *Stenothoe alaskensis*.

Rami of the first pair of uropods equal and about two thirds the length of the peduncle; outer ramus of the second pair two thirds the length of the inner one, which is considerably shorter than the peduncle; third

uropods with the ramus about equal to the stout peduncle, the two segments of the ramus of subequal length. Telson oblong-ovate.

Length 6 mm.

In this species the inner plates of the maxillipeds are broader than is usual in the genus, and the palp of the first maxillæ has but a single joint, a feature which does not accord with the definition of the genus as given originally by Dana. The other characters of this species, however, are so much like those of the recognized members of this genus that I have assigned it to *Stenothoe* rather than institute a new genus for its reception.

Family *PARAMPHITHOIDÆ*.

SYMPLEUSTES GLABER (Boeck).

Amphithopsis glaber Boeck.

A single specimen from St. Paul, Pribilof Islands, Alaska.

Family *IPHIMEDIDÆ*.

ODIUS CARINATUS (Bate).

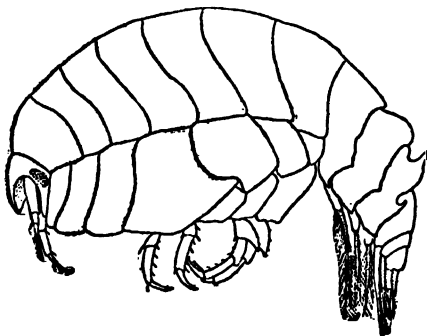


FIG. 123. *Odius carinatus*.

of the two forms. The Pribilof specimen is here figured, so that it may be easily compared with specimens from other regions.

A single specimen was collected on the island of St. Paul, one of the Pribilof Islands, in Bering Sea. The telson in this specimen is a little shorter than in the one figured by Sars in his *Crustacea of Norway*, but otherwise the Alaskan form agrees very closely with Sars' description and figures. There can be no doubt, I believe,

Family *GAMMARIDÆ*.

GAMMARUS LOCUSTA Linnæus.

A single specimen from Garforth Island, Muir Inlet, Glacier Bay.

GAMMARUS PULEX (De Geer).

Several specimens from fresh water on Popof Island and also from a pond on the west side of Muir Glacier (Kincaid).

GAMMARUS CONFERVICOLUS Stimpson.

Sitka, Alaska, and Grenville Channel (Ritter).

GAMMARUS PUGETTENSIS Dana.

DANA, Crustacea, U. S. Expl. Exp., XIV, Pt. II, p. 957, pl. 66, fig. 1, a-g, 1852.

Dana states that the fourth segment of the abdomen in this species is acute above, but it is the fifth segment instead of the fourth which is acute. Dana's figure shows that the second pair of uropods articulate with the segment which bears the acute dorsal process. Several specimens were obtained at Garforth Island, in Glacier Bay, by the Harriman Expedition.

CARINOGAMMARUS SUBCARINATUS (Bate).

Several specimens from Wrangell, Garforth Island, and Dutch Harbor, Alaska.

MAERA DUBIA Calman.

Several specimens from Popof Island, Alaska, taken from under rocks on the shore.

Family *PHOTIDÆ*.**GAMMAROPSIS TENUICORNIS** sp. nov.

Type from Puget Sound (a single male specimen).

Eyes oblong, oblique. Anterior angle of the head terminating in an acute upturned tooth. Antennæ slender, of subequal length, and over half the length of the body; the first joint of the peduncle of the first pair stout and slightly over half the length of the second, which is very slender and a little longer than the third; flagellum nearly as long as the peduncle, the secondary flagellum composed of seven elongated joints and about equaling the last joint of the peduncle. Second antennæ with the peduncle slender, the gland cone of the second joint elongated and narrow, last two joints of subequal length; flagellum shorter than the peduncle, the joints shorter but scarcely stouter than those of the flagellum of the first pair. Coxal plates but little deeper than their segments, the first pair small and armed with several serrations around the postero-inferior angle, the corresponding angle of the three succeeding coxal plates with a minute denticle. First gnathopods rather slender and elongate, the basal joint bent forward, the carpus narrow, longer than the propodus, and widening gradually toward the distal end; hand with the posterior margin quite evenly curved. Second gnathopods

large and elongated; hand oblong, broader and much longer than the carpus, the palm oblique, with a broad tooth at the posterior end and having a concavity in the center in which a large tooth is situated. Posterior peraeopods rather slender, with the basal joints comparatively narrow. Uropods slender and projecting backward to about an equal

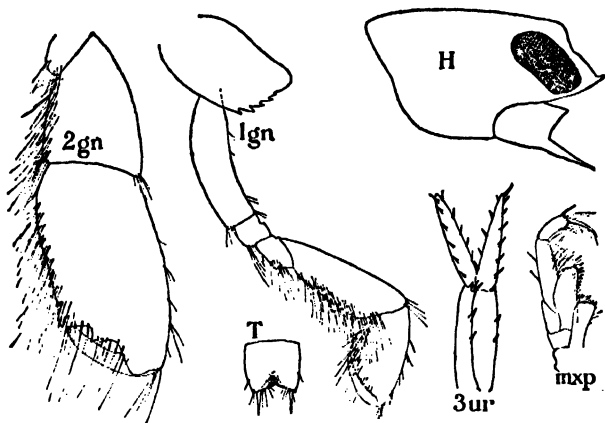


FIG. 124. *Gammaropsis tenuicornis*.

distance, the first pair with the rami of equal length and a little shorter than the peduncle; outer ramus of the second pair shorter than the inner; rami of the posterior pair subequal and about as long as the peduncle. Telson nearly square, somewhat incised posteriorly, each lobe with a strong terminal spine and several setæ.

Length 9 mm.

In the elongated gnathopods this species resembles *Megamophus*, but differs from that doubtfully distinct genus in having a much longer secondary flagellum on the first antennæ. From *Gammaropsis erythrophthalmus* (Lillg.) this species differs in having more slender antennæ and much more elongate and differently formed gnathopods. It is apparently more nearly allied to *G. melanops* Sars, but it differs from that species in having the postero-lateral angle of the first coxal plates strongly serrated, in having a longer accessory flagellum on the antennules, and in the form of the telson. From *G. nana* Sars it differs in having elongated instead of round eyes, in having a long accessory flagellum on the antennules, and in the form of both pairs of gnathopods. (See accompanying figures.)

Family *AMPHITHOIDÆ*.

AMPHITHCÆ HUMERALIS Stimpson.

Two specimens from Puget Sound, the type locality.

A specimen of another species of *Amphithæ* was taken along with the preceding specimens. It is perhaps of the same species as that described by Calman as *Amphithæ* sp.,¹ although it does not quite agree with Calman's description. As the specimen is a female, it can not be identified with certainty.

ERICHTHONIUS DIFFORMIS Milne Edwards.

Several specimens collected at Puget Sound by Professor Kincaid.

Tribe Caprellidea.

CAPRELLA CILIATA Sars.

Two specimens from Orca, Prince William Sound, Alaska.

CAPRELLA IRREGULARIS Mayer.

Several specimens from Orca, Alaska, from among *Thuiaria turgida*.

CAPRELLA KENNERLYI Stimpson.

Several specimens from Popof Bay, Yakutat, Dutch Harbor, and Kadiak Harbor, Alaska.

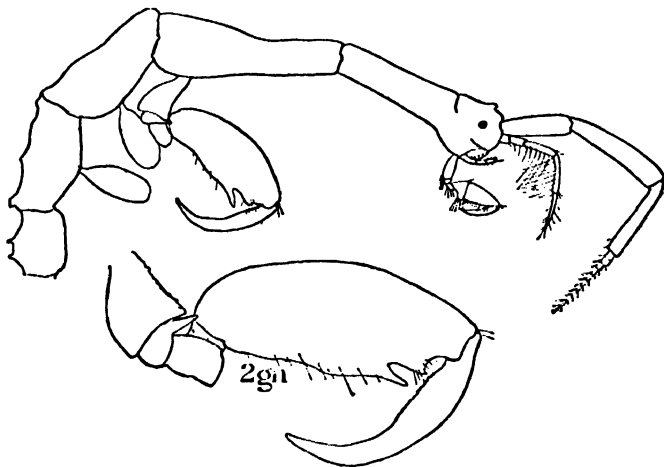
CAPRELLA ALASKENSIS sp. nov.

Type from Orca, Prince William Sound, Alaska (a single male).

Anterior portion of the body much elongated. Head with a blunt spine or tubercle over the eye. First antennæ stout, the first joint of the flagellum about two thirds the length of the second, which is only a little longer than the third; flagellum about the length of the preceding joint of the peduncle and composed of eleven segments. Second antennæ slender, not reaching the base of the last joint of the peduncle of the first pair, the posterior margin fringed with long hairs; flagellum two-jointed and nearly as long as the preceding joint of the peduncle. First segment of the thorax about three times as long as deep; second segment tumid posteriorly but narrowed and produced in front of the gnathopods; third and fourth segments with a pair of tubercles near the middle and a larger pair at the posterior end of the dorsal side, the tubercles of the third segment much less prominent than those of the fourth; fifth seg-

¹ Ann. N. Y. Acad. Sci., xi, p. 273, 1898.

ment with two pairs of dorsal spines or tubercles; tubercles on the sides of the body at the antero-inferior angles of the third and fourth segments and at the postero-inferior angle of the fifth segment. Palm of the anterior gnathopods straight and pectinated with regularly spaced, up-turned spines; inner margin of the dactyl furnished with small jagged teeth. Second gnathopods situated almost at the posterior extremity of the segment; basal joint short, broad, distally expanded, and somewhat



25. *Caprellia alaskensis*. The posterior thoracic segments were missing in the specimen figured.

produced at the anterior angle; anterior margin roughened with small tubercles such as occur elsewhere on the appendage; ischium produced anteriorly into a long, narrow-pointed process; hand narrow, much longer than all the preceding segments; the palm devoid of a spine or tubercle at the upper end, somewhat tumid a little below the middle of the hand, and armed inferiorly with a large narrow spine separated by a deep narrow sinus from a broad tooth below; dactyl large, rather abruptly curved upward near the middle, slightly swollen in the basal half, where the inner margin is furnished with some small irregular denticulations. Gills narrowly oval.

The specimen from which the description and figures of this species were made had lost the posterior peraeopods and last two segments of the thorax. In the elongation of the anterior part of the body and the insertion of the second gnathopods this species resembles *Caprella*

aquilibra Say, but it differs from Say's species in having no spine on the ventral side of the body between the bases of the second gnathopods, in having the ischium of these appendages armed in front with a very prominent spinous process, and in having the palm devoid of a spine at the upper end. Owing to the two latter characteristics, this species is one which is especially well marked.

CAPRELLA SCABRA sp. nov.

Type from Orca, Prince William Sound, Alaska (numerous specimens found among specimens of the Hydroid *Thuiaria turgida*).

Adult male: Body robust, narrowed in front of the insertion of the second gnathopods, and scabrous with minute spinules which become larger on the posterior segments. Head armed above with a prominent spine, behind which there may be a smaller spine or tubercle. First an-

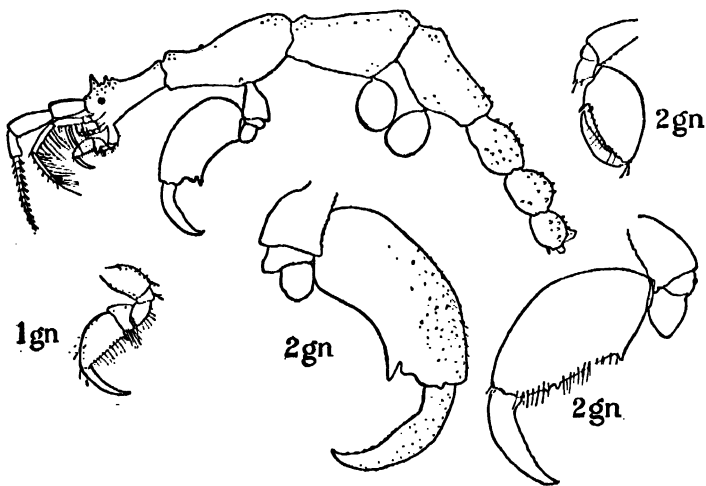


FIG. 126. *Caprella scabra*. The three figures of the second gnathopods are drawn from male specimens of different ages.

tennæ scarcely a third the length of the body, the peduncle very stout, the first joint about two thirds the length of the second and a little longer than the comparatively slender third joint; flagellum shorter than the peduncle and composed of about eleven segments. Second antennæ slender, much shorter than the first, and fringed with long hairs posteriorly; flagellum two-jointed and a little longer than the last joint of the peduncle. First segment of the thorax about twice as long as deep and sometimes armed

with a small dorsal spine at the anterior end. Second segment tumid posteriorly, but narrowed in front of the gnathopods; the second, third, and fourth segments are more or less elevated at the two ends and decrease successively in length. Second gnathopods inserted behind the middle of the segment, the basal joint very short and broad, widened distally, and somewhat produced at the antero-distal angle, the anterior margin roughened from the small prominences similar to those occurring on the surface of the body and the other appendages; merus produced and rounded below; carpus very short; hand oblong, curved backward, much longer than all the preceding segments; palm concave, devoid of a spine near the upper end but furnished with a large spine near the lower extremity, which is separated by a deep narrow sinus from a tooth below. Gills broadly oval to nearly round. Posterior pereopods with the palm occupying over four fifths of the posterior margin of the hand, and defined above with a prominence bearing a pair of serrated spines; carpus with an oblique row of tubercles on the lower edge. Penes median. Abdominal appendages clearly two-jointed.

Length, 19 mm.

The young males differ considerably in appearance from the adults; the antennæ are nearly equal in length and thickness and the peduncle of the first pair relatively less stout; the first two segments of the thorax are much less elongated, and the second gnathopods are joined near the middle or even in front of the middle of the segment; the hand of the second gnathopods is oval in outline and convex instead of ~~concave~~ posteriorly, and is furnished with a prominent tooth at the upper end of the palm, near which is a small spine on the surface of the hand; near the lower end of the palm are two small teeth. In somewhat larger specimens the hand is more elongated, the palm straighter, the teeth near the lower end of the palm more prominent; the upper tooth becomes more reduced and persists in quite large specimens, but finally disappears. The different insertion of the second gnathopods in the adult males is brought about by the elongation of the anterior portion of the second thoracic segment.

In the female the first antennæ are but little longer and scarcely stouter than the second pair, and the first two segments of the peduncle of the first pair are not enlarged; the first segment of the thorax is about as deep as long; the second gnathopods are inserted in front of the middle of the second thoracic segment, the anterior portion of the segment not being prolonged as it is in the adult male.

The roughness of the body is subject to considerable variation. Some specimens are nearly smooth; others, and especially the females, are furnished with short spines on the posterior segments.

This species agrees closely with *Caprella drepanocheir* Mayer in the general form of the body, the peculiar character of the second gnathopods of the male, the form and armature of the posterior peraeopods. It differs from that species in possessing a prominent spine on the upper side of the head, in having stouter first antennæ with fewer segments in the flagellum, and in having broader gills. The absence of a spine near the upper end of the palm of the second gnathopods of the male may not be a distinction of much importance, as older specimens of *drepanocheir* than those which Mayer obtained (he had but four specimens, all males) might show the same feature. In view of the great variability of the species of *Caprella*, I do not feel entirely confident that this species may not ultimately prove to be but a variety of the one described by Mayer; but one has to dispose of it somehow, and calling it a variety of the latter involves the assumption that the two will be found to be connected by intermediate forms. So far as can be determined at present, the two species are quite distinct, and until the contrary is proved it will, I believe, be best to designate this form by a respectably brief binomial.

CAPRELLA KINCAIDI sp. nov.

Type from St. Paul, Pribilof Islands, Alaska (six male specimens collected by T. Kincaid).

Body stout, scabrous, and spiny above. Head much deeper than long, armed above with a pair of large spines in front of which is a prominent

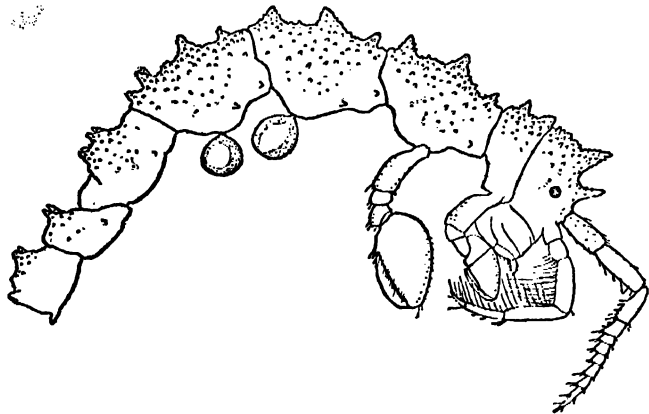


FIG. 127. *Caprella kincaidi*.

median spine. First thoracic segment much deeper than long and armed above with two pairs of spines; the three following segments of the thorax

less than twice as long as deep and armed above with three pairs of spines, of which the middle pair is the largest; fifth segment with two pairs of dorsal spines, the two following segments with a single pair of dorsal spines near the middle, the last segment with an additional pair of smaller spines or tubercles at the posterior end of the upper side. Eyes small and round. Antennæ of subequal length and less than half as long as the body; the first pair with the first joint of the peduncle about three fourths as long as the second and but slightly longer than the third; flagellum scarcely as long as the peduncle. Second antennæ fringed posteriorly with long setæ, the last joint of the flagellum but slightly longer than the preceding one; flagellum two-jointed and about as long as the last joint of the peduncle. Gnathopods more or less scabrous

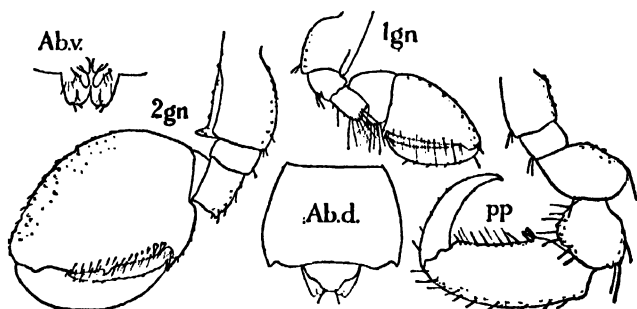


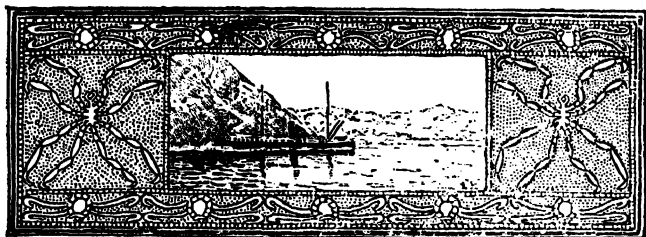
FIG. 128. *Caprella kincaidii*. Ab.d. dorsal side of abdomen and last thoracic segment; Ab.v. ventral side of abdomen.

with minute short spinules such as occur on the surface of the body, the hand of the second pair broadly ovate and furnished with a tooth at the upper end of the palm and a smaller tooth a little below the middle. Gills nearly round. Palm of the posterior peræopods occupying three fourths of the posterior margin of the propodus, and defined above by a prominence bearing a pair of serrated spines. Penes median; the succeeding abdominal appendages apparently one-jointed.

Length, 7 mm.

This species is easily distinguished from most members of the genus by its short, stout, subequal antennæ, the arrangement of spines on the head, and the very short first segment of the thorax.

**PYCNOGONIDA OF THE WEST
COAST OF NORTH AMERICA**



PYCNOGONIDA OF THE WEST COAST OF NORTH AMERICA

BY LEON J. COLE

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INTRODUCTION.

THE Pycnogonida collected by the Harriman Alaska Expedition form the basis of the material described in the following pages. They were obtained by those members of the party who devoted their attention to the invertebrate forms, Professor W. E. Ritter, Dr. W. R. Coe, and Professor Trevor Kincaid; I have also to thank Professor Kincaid for several specimens collected by him upon a previous trip to the Pribilof Islands, in 1897. In addition to the above, the Pycnogonida in the collection of the University of California, from various places along the California coast, were placed at my disposal. Finally several lots, also from California, were turned over to me by Dr. S. J. Holmes, to whom I am indebted for many courtesies. I have been generously permitted to include descriptions of all these forms, so that, with the exception of two previous notes, each describing a new species, of which one is included in the present collections, all that has been written on the littoral Pycnogonida of the west coast of North America will be found in this paper.

Of the two species previously described from the Pacific coast the first was established by Stimpson ('64) from a single specimen, which he called *Ammotheca longicaudata*, collected in Puget Sound by the Northwest Boundary Commission. Stimpson's description of the species is preliminary and indeterminate; the fuller description and figures were never published. In 1892 Ives ('92) described a species of *Pycnogonum* from San Diego, California, which he named *Pycnogonum stearnsi*, after the collector. These constitute the references to the shore forms on the Pacific coast of North America. Schimkewitsch ('93) has described the deep-sea specimens collected by the *Albatross* in the Gulf of California and to the southward, none of which was taken in less than 660 fathoms of water, and in a previous paper (Schimkewitsch, '89) he describes the collections of the *Vettor Pisani*, a part of which were made in the Gulf of Panama and at various places along the coast of South America. On the Atlantic coast of North America the chief systematic work has been done by Wilson ('78^a, '78^b, '80, and '81).

The collections here reported comprise altogether 108 specimens, of which 42 are adult males, 39 adult females, and 27 immature specimens. These represent 13 species, included in 9 genera. Specimens of all these species have been deposited in the Museum of the University of California, including the type specimens of those species which are here described for the first time. Duplicates, so far as possible, will be deposited in the United States National Museum.

GEOGRAPHICAL DISTRIBUTION.

The available data are so meager that no very general conclusions can be drawn respecting the distribution of Pycnogonida on the Pacific coast. It may be worth while, however, to consider the question briefly, and to compare the results with what is known of the distribution of other groups in that region. The accompanying table shows graphically the distribution of the Pycnogonida known from the west coast, including the species reported from Puget Sound, which may possibly be synonymous with one of the species of *Ammotheca* reported from Alaska.

In the table the localities are arranged in order from the north and west toward the east and south, from Bering Sea to southern California. The species are similarly arranged in the order of their first occurrence in the list of localities. It will be noticed that there is a great gap in the series of localities extending the whole distance from Prince William Sound, Alaska, to northern California, except for the single record of Stimpson at Puget Sound. This gap is indicated in the table by double lines.

It seems at first surprising that more of the species are not identical with North Atlantic forms; but when it is taken into account that only four species have been found to the northward on the Pacific side, and that one of these, *Phoxichilidium femoratum* Rathke, is circumpolar, being found also on the coasts of northern Europe, the proportion does not appear so small. Furthermore, two other of the four species, *Ammonothea latifrons* and *Ammonothea alaskensis*, correspond fairly closely to the European forms *Ammonothea echinata* (Hodge) and *Ammonothea levis* (Hodge) respectively, and it is not unlikely that they have been differentiated from common circumpolar types.

In discussing the distribution of the Hydroids collected by the Harriman Alaska Expedition, Nutting (: 81) takes exception to the definition of the Pacific faunal areas made by Dall ('76) in 'An Introductory Note to the Report on Alaskan Hydroids, by Mr. Clark.' Dall extended what he called the *Oregonian Fauna* from Monterey to the Shumagin Islands; Nutting would not extend this southern fauna farther northward than about the region of Puget Sound. Then, instead of a break at the Shumagin Islands with a distinct fauna beyond (called the *Aleutian* by Dall), the results of further research would seem to show that from Puget Sound to the Aleutian Islands the fauna is fairly continuous and homogeneous, and to this Nutting has applied the name *Alaskan Fauna*. Reasoning from the close relation existing between Pycnogonida and Hydroid colonies, the former being so often found with and perhaps obtaining their food from the latter, and the larvæ, in some cases at least, being known to be parasitic upon the Hydroids, either living within the gastral cavity (Dohrn, '81, p. 76) or attached to the outside with the proboscis buried in the body of the host (von Lendenfeld, '83), it would not be at all

surprising if a correlation were found in their distribution. In this connection the results presented in the table may have some bearing on the question of a line of demarcation at the Shumagin Islands. The evidence does not favor such a distinction, for it will be noticed that of the two forms obtained at Orca, both are found at Popof Island, and one of them at Unalaska, still farther west.

As might perhaps be expected, all the species from California are different from those found in Alaska; but in determining the position of the dividing line between the two faunas the data at hand give no help, although, as Nutting supposes, it is not at all unlikely that the line is not far to the southward of Puget Sound.

The fauna of the California coast is in some respects strikingly like that of the Gulf of Naples. For instance, two representatives of the genus *Ammothella* are found along the coast of that State, and none to the northward, while of the other four species which apparently belong to this genus (see p. 273), but which have heretofore been referred to the unrestricted genus *Ammothoa*, three are recorded from Naples by Dohrn ('81), and one from the Bermudas by Verrill (: 00). The genus *Clotenia* is known only from the original species, *C. conirostris* Dohrn, from Naples, and *C. occidentalis* from Pacific Grove, California. This similarity in the faunas of the two places is probably brought about merely by the similarity in temperature rather than by any direct faunal relation, as a similarity can be found between the forms occurring on the coast of California and those of any place having much the same thermal conditions. For example, the two previously known species of *Lecythorhynchus* have been recorded only from Japan, where the conditions are much the same as on the California coast.

CLASSIFICATION AND TERMINOLOGY.

The classification of the Pycnogonida is at best very unsettled. The group as a whole is remarkably homogeneous, the classification depending for the most part upon such characters as the development or non-development, or the loss in adult life, of certain of the anterior appendages. Other differences are often

correlated with these, giving some justification for the groupings, but it is not at all improbable that widely separated forms are in this way often put together; conversely, specimens of the same species but of different ages have sometimes been placed even in different families.¹ Like my predecessors, however, for want of a better standard, I have retained those groupings which seemed most convenient.

In the matter of the terminology of parts I have, with a few exceptions, followed that given by Meinert ('99) in the 'Pycnogonida of the Danish Ingolf-Expedition,' which in turn differs little from that used by Sars ('91, and previous papers). In using this system rather than the more non-committal nomenclature of Dohrn, I have been influenced by two considerations. In the first place, these names, or names much like them, have been on the whole more generally employed in works on Pycnogonida. Secondly, the Pycnogonida form such a highly specialized and well differentiated group that terms similar to those used for other classes of Arthropoda can be employed without necessarily implying that the parts so designated are homologous, but merely analogous in position, shape, or use. Furthermore, the tendency of recent writers has been to use special names for parts, rather than more general appellations, and it is of the utmost importance that some system should be uniformly established.

In the following pages the word 'body' is used as a general term to include the proboscis, caudal segment, and lateral processes, while 'trunk' has for convenience been restricted to only the main portion of the body, the proboscis, caudal segment, and lateral processes being excluded. Instead of 'ovigerous leg' the word 'oviger' has been employed, and simply 'leg' is made to take the place of the cumbersome phrase 'ambulatory leg,' as there is no danger of confusion. When the tarsal joints and the claw are spoken of as a whole, that portion of the leg is called the 'foot'; and when the ventral margin of the second tarsal joint is differentiated, the basal expansion is spoken of as the 'heel,' and the

¹ Thus Wilson ('80), before it was recognized that *Achelina* included merely the adults of those forms placed in the genus *Ammonothea*, put *Ammonothea* in the family Nymphonidae, while *Achelina* was classed along with *Tanystylum* in a family which he called the Achelidae.

remainder of the surface as the 'sole.' In describing the joints of the palpi and ovigera the abbreviations *j.1*, *j.2*, etc., are often used, and similarly the joints of the legs are abbreviated to *c.1*, *c.2*, *c.3* for the first, second, and third coxal joints, *f.* for femoral, etc., when the meaning cannot be mistaken. In speaking of the dimensions of a joint, 'length' is always in the direction of the axis of the appendage, 'breadth' at right angles to it, regardless of the proportions of the two. The same rule also holds true for the parts of the body, 'length' being in the direction of the axis of the animal; but when the lateral process alone is spoken of, it has the same long axis as the leg. In general, proportionate measurements are used in preference to absolute, as it is thought they will prove more practicable in determining species. Measurements of the length of the whole animal, or 'body,' as it is usually called, are taken from the tip of the proboscis to the tip of the caudal segment. When possible the specimen is flattened out so that the proboscis projects straight forward and the caudal segment straight backward in order to get this measurement, and when this is not possible it is approximated as nearly as can be. Extent is another measurement which it is difficult to obtain with any degree of accuracy. When practicable I have done this by extending the specimen as fully as possible and measuring directly—usually from the tip of the second leg of one side to the tip of the third leg of the other. For one reason or another this can not always be done conveniently, and in such cases it is often necessary to get the leg measurement joint by joint, and to determine the total extent approximately in this way. Such a degree of accuracy is generally not necessary in determining the absolute size of the species, but is often of much importance in order to get proportion of extent to length, and to other dimensions, in the same specimen. Most authors give measurements for at least length and extent, but as they seldom state just how they are made, they can be used only with considerable caution.

The following comparative table of terms used by several of the more recent authors may be of service in comparing descriptions. A much more complete synonymy will be found in Meinert's report ('99).

COMPARATIVE TABLE OF TERMS USED BY VARIOUS AUTHORS IN DESCRIBING PYCNOGONIDS.

This Paper.	Meinert, '99.	Sars, 'gr.	Hoek, '84.	Dohrn, '81.	Wilson, '80.
first trunk segment	first segment of trunk (<i>segmentum corporis primum</i>)	cephalic segment	cephalothoracic segment	vorderes Segment	oculiferous segment
neck	neck (<i>collum</i>)	neck	.....	.....	neck
second trunk segment	second segment of trunk (<i>segmentum corporis secundum</i>)	second trunk segment	first true thoracic segment	zweite Segment	(second segment)
third trunk segment	third segment of trunk (<i>segmentum corporis tertium</i>)	third trunk segment	.....	dritte Segment	(third segment)
fourth trunk segment	fourth segment of trunk (<i>segmentum corporis quartum</i>)	last trunk segment	.....	letzte Segment	posterior segment
lateral process	lateral process (<i>processus corporis lateralis</i>)	lateral process	lateral process	seitliche Fortsatz	lateral process
caudal segment	caudal segment (<i>segmentum caudale</i>)	caudal segment	abdomen	Hinterleib	abdomen
eye tubercle	oculiferous tubercle (<i>tuberculum oculare</i>)	oculiferous tubercle	oculiferous tubercle	Augenhügel	oculiferous tubercle
eyes	eyes	cornere	eyes	Augen	eyes
proboscis	proboscis (<i>rostrum</i>)	proboscis	proboscis	Schnabel	rostrum
cheliferous	cheliferous (<i>cheliferus</i>)	cheliferous	mandible	Extremität I	antenna
scape	scape (<i>scapus</i>)	scape	basal joint of mandible	erste Glied	basal joint
chela	chela, or hand (<i>chela</i>)	chela, or hand	second joint	zweite Glied	chela
palm	palm (<i>palmus</i>)	palm	.....	.....	} second joint
immovable finger	immovable finger (<i>acumen v. digitus immobilis</i>)	immovable finger	.....	Schere	dactylus
movable finger	movable finger (<i>pollex v. digitus mobilis</i>)	movable finger	.....	Extremität II	palp
palp	palp (<i>palpus v. pes palpi-formis</i>)	palpus	.....	.....	.....

oviger terminal part of the oviger	ovigerous leg (<i>pes ovifer</i>) terminal part of the ovigerous leg (<i>pars terminalis pedis oviferi</i>)	false leg terminal part of false leg	ovigerous leg	Extremität III	accessory leg
egg-mass	egg-globe (<i>globus ovarum</i>)	egg-globe	egg-mass, or egg-packet	Eiersack	egg-mass
leg	ambulatory leg (<i>pes ambulatus</i>)	ambulatory leg	leg	Extremitäten IV-VII	leg
first coxal joint (c.1)	first coxal joint (<i>articulus coxalis primus</i>)	first coxal joint	first joint of leg	Glied 1	basal joint
second coxal joint (c.2)	second coxal joint (<i>articulus coxalis secundus</i>)	second coxal joint	second joint of leg	Glied 2	second joint
third coxal joint (c.3)	third coxal joint (<i>articulus coxalis tertius</i>)	third coxal joint	third joint of leg	Glied 3	third joint
femoral joint (f.)	femoral joint (<i>femur</i>)	femoral joint	fourth joint of leg	Glied 4	fourth joint
first tibial joint (t.1)	first tibial joint (<i>articulus tibialis prior</i>)	first tibial joint	fifth joint of leg	Glied 5	fifth joint
second tibial joint (t.2)	second tibial joint (<i>articulus tibialis alter</i>)	second tibial joint	sixth joint of leg	Glied 6	sixth joint
first tarsal joint (t.1)	first tarsal joint (<i>articulus tarsalis prior</i>)	tarsus	first tarsal joint	Glied 7	tarsus
second tarsal joint (t.2)	second tarsal joint (<i>articulus tarsalis alter</i>)	propodus	second tarsal joint	Tarsus'	propodus
heel	.....	'lamellar expansion'	.....	Hacke	.....
sole	.....	.....	.....	Sohle	.....
claw, or terminal claw (cl.)	claw (<i>unguis</i>)	terminal claw	claw	Kralle	dactylus
auxiliary claws (<i>aux. cl.</i>)	auxiliary claws (<i>unguiculi auxiliares</i>)	auxiliary claws	auxiliary claws	Nebenkrallen	auxiliary claws

KEY TO THE SPECIES

The following key is adapted only to the species of Pycnogonida described in this paper, and is applicable only to adult forms. If a chelate specimen not positively known to be adult cannot be identified by it, the specimen may be an immature individual and can perhaps be traced by considering it under A, forms with "Chelifori present, not chelate in adult."

- A. Chelifori present, not chelate in adult; palpi present; ovigera 10-jointed, present in both sexes (*AMMOTHEIDÆ*).
- B. Body rather elongate, distinctly segmented; lateral processes well separated; chelifori 1-jointed; palpi 9-jointed (*Lecythorhynchus*).
- C. Proboscis subcylindrical or elliptical, constricted in its middle third *Lecythorhynchus marginatus*, p. 260
- B'. Body more or less disciform; segmentation often indistinct; lateral processes approximated.
- C. Chelifori 2- or 3-jointed; palpi 8- or 9-jointed.
- D. Chelifori 2-jointed; palpi 8-jointed (*Ammothea*).
- E. Chelifori more than half as long as proboscis; caudal segment reaching at least to middle of second coxal joint of fourth pair of legs *Ammothea latifrons*, p. 263
- E'. Chelifori less than half as long as proboscis.
- F. Proboscis narrow, fusiform; forms less than 4 mm. in length and 20 mm. in extent.
- G. Protuberance on dorsal side of first coxal joint about half as long as the joint; genital protuberance in male of about the same length.
Ammothea alaskensis, p. 266
- G'. Protuberance on dorsal side of first coxal joint fully three fourths as long as the joint; genital protuberance in ♂ only about half as long as protuberance on first coxal joint . . . *Ammothea gracilipes*, p. 269
- F'. Proboscis broadly clavate, truncate at the apex; forms over 4 mm. in length and 20 mm. in extent.
Ammothea pribilofensis, p. 270
- D'. Chelifori 3-jointed; palpi 9-jointed (*Ammothella*).
- E. Eye tubercle low, rounded; first 2 or 3 trunk segments with a conical tubercle dorsally near the posterior border.
Ammothella tuberculata, p. 273
- E'. Eye tubercle tall, slender; caudal segment slender, curved, elevated, spinose; first and second trunk segments with a pair of spines dorsally near the posterior border.
Ammothella spinifera, p. 275
- C'. Chelifori usually 1-, sometimes 2-jointed; palpi 6- or 7-jointed. (*Tanystylum*).

- D. Chelifori 2-jointed *Tanystylum intermedium*, p. 278
 C''. Chelifori 1-jointed; palpi 4-jointed; body very much shortened (*Clotenia*) *C. occidentalis*, p. 281
 A'. Chelifori present, chelate; palpi absent; ovigera present in the male only, 5- or 6-jointed (*Phoxichilidium*).
 B. First trunk segment produced very little, or not at all, anteriorly beyond base of proboscis; lateral processes well separated; ovigera 5-jointed (*Phoxichilidium*) . . . *P. femoratum*, p. 283
 B'. First trunk segment projecting somewhat anteriorly beyond base of proboscis; body concentrated, lateral processes closely approximated (*Halosoma*) *H. viridintestinalis*, p. 286
 B''. First trunk segment projecting well beyond base of proboscis, forming a slender neck; body elongate, lateral processes well separated; ovigera 6-jointed (*Anoplodactylus*).
 C. Caudal segment directed upward. *Anoplodactylus erectus*, p. 289
 A''. Chelifori and palpi both absent; ovigera present in the male only (*Pycnogonidae*).
 B. Ovigera 9- or 10-jointed (*Pycnogonum*).
 C. Ovigera 10-jointed *Pycnogonum stearnsi*, p. 292

SYSTEMATIC DISCUSSION OF SPECIES.

PYCNOGONIDA.

Family ACHELIDÆ.

Chelifori present, chelate in larva but not in adult; palpi present; ovigera 10-jointed, present in both sexes.

Genus *Lecythorhynchus* Böhm ('79b).

Corniger Böhm, '79a, p. 186.

Trunk rather stout, sutures well defined; lateral processes rather short, well separated. Caudal segment moderately long, pointed upward. Eye tubercle slightly anterior to middle of first segment, pointed. Proboscis comparatively long, approximately cylindrical. Chelifori either 1-jointed (mere knobs) or 2-jointed.¹ Palpi long, 9-jointed. Ovigera 10-jointed. Legs moderately long and stout; first tarsal joint very small; second tarsal joint stout, curved; claw strong; auxiliary claws large.

Remarks.—Böhm first named this genus *Corniger*, but later, finding that name untenable,² changed it to the present one. Besides the species here described, the genus at present includes only the two species recorded by Böhm, both of which came from Japan.

¹ In *Lecythorhynchus armatus* Böhm.

² "Da die Bezeichnung *Corniger* indess bereits für eine Fischgattung vergeben ist, so mag dieselbe durch *Lecythorhynchus* ersetzt werden."—Böhm ('79b).

LECYTHORHYNCHUS MARGINATUS sp. nov.

Plate XI, figs. 1-2; plate XV, figs. 1-8.

Type.—♂, University of California, No. 19,501, San Pedro Point, California; ♀, University of California, No. 19,502, Dillon's Beach, California.

Trunk rather stout, second segment broadest; sutures well defined; lateral processes squarish, shorter than breadth of trunk segment; the first pair projecting forward at an angle of about 45° , the second at a lesser angle, third pair projecting somewhat backward, and fourth pair still more so. There is in some cases an indication of a slight chitinous ridge on the mid-dorsal line of the lateral processes.

Caudal segment comparatively long, about equal to second joint of palp, nearly vertical, subconical, with a small nodular projection on the anterior side at the apex; anal opening just posterior to this projection.

Eye tubercle small, pointed, placed rather nearer to the bases of the chelifori than to the posterior border of the segment. Eyes dark, comparatively large, crowded.

Proboscis nearly as long as trunk, projecting obliquely downward, sub-cylindrical or elliptical, but constricted in the middle third, thus appearing somewhat swollen both behind and ahead of the middle; tapering gradually in the distal fourth to the rounded extremity.

Chelifori short and rudimentary, thumb-like, simple, parallel or nearly so.

Palpi arising nearly lateral to the chelifori, overreaching the proboscis by about half its length. Nine-jointed: *j.1* short, square; *j.2* three or four times as long; *j.3* short again like *j.1*, lying at middle of proboscis; *j.4* equal to *j.2*; *jj.5, 6, 7, 8, and 9* all short and rounded, altogether about equal in length to the two preceding joints; *j.5* slightly projecting. The palpi usually make a zigzag line due to a sharp bending downward at the third joint and a bend forward again at the fifth. There are a few small spines on the palpi, especially on the fifth and succeeding joints.

Ovigeras somewhat different in structure as well as in size in the two sexes. In the male they are about equal in length, when straightened out, to the length of the whole animal. First joint comparatively short and broad; *j.2* about twice as long, more slender; third as long as first, slender like second; fourth and fifth about equal to second; sixth shorter; seventh small, rounded, armed with a group of small backwardly pointing spines; *jj.8, 9, and 10* successively smaller and in line, but *j.8* proceeds from the side of *j.7*, thus forming a sharp angle at this place. These joints also have a few very small spines. The appendage as a whole is sigmoid-

ally curved. The ovigera of the female are noticeably smaller than those of the male; the first three joints are somewhat similar, but the fourth is shorter in proportion, and from this point to and including the tenth they decrease more or less regularly in size. The eighth, ninth, and tenth follow in line with the seventh, in this way making the terminal part of the appendage straight instead of sharply bent as in the male. With the exception of the spines mentioned on the distal joints in the male, the ovigera of both sexes are practically smooth.

The egg-masses are subglobular, fairly compact, and the eggs proportionately rather large.

Legs somewhat over twice the length of the animal, comparatively rather stout. First coxal joint short; *c.2* about twice as long as *c.1*, swollen on ventral side in distal third in both sexes, the genital opening being situated on this swelling; *c.3* little longer than *c.1*; *f.* about equal in length to the coxal region, distended somewhat by the developing eggs in the female; in the male the so-called agglutinative gland opens on a slight prominence on the dorsal side about a fourth of the distance from the distal end of the femoral joint, this prominence not being present in the female; *t.1* and *t.2* about equal in length, slightly shorter than *f.*; *ts.1* very short, triangular; *ts.2* stout, strongly arched; *cl.* falciform, about half as long as *ts.2*; *aux. cl.* well developed, about half as long as *cl.* Convex proximal half of the inner (ventral) border of *ts.2* (the 'heel') armed with 5 or 6 strong, somewhat distally curved spines; concave distal half (the 'sole') beset with a close row of very small spines; the dorsal border of the same joint bears a series of comparatively long slender bristles. First tarsal joint armed with 1 or 2 strong and a number of short bristles. Tibial joints with a few scattered short bristles, especially on the dorsal margin; a longer one near the distal end of each joint, while the femoral has 2 or 3 in a similar position. Aside from these the legs are almost smooth, though in some cases there are scattered hairs, especially on the basal joints. Along the mid-dorsal line of *c.1*, and sometimes extending on to the basal part of *c.2*, is a chitinous ridge ('Chitinleiste,' Böhm, '79^a, p. 188).

Integument moderately thick, with numerous cavities; mostly smooth, but with scattered microscopic bristles.

Length of ♀: body 3 mm., proboscis 1.3 mm., caudal segment 0.4 mm., extent 20 mm. Male slightly smaller and more slender.

This species has been found in three localities on the California coast, as shown in the accompanying table. Its range is undoubtedly more extensive than this, and it is not unlikely that it will be found in northern California and south to San Diego.

SPECIMENS EXAMINED.

Lot. ¹	Locality.	No. of specimens.	Date.	Source.
10	San Pedro Pt., San Mateo Co., Calif.	1 ♂	Sept. 2, 1895	Univ. of Calif.
18	Pacific Grove, Monterey Co., Calif.	1 ♀	Dec. 29, 1898	" " "
20	Dillon's Beach, Sonoma Co., Calif.	1 ♂, 1 ♀	Nov. 26, 1898	" " "

Remarks.—This species in a general way resembles *L. hilgendorfi* Böhm, but may readily be distinguished from that species by the differently shaped proboscis, its length, absolute and relative to the palpi, the restriction of the chitinous ridges, which in that species extend to the ends of the legs, and, judging by Böhm's figures (Böhm, '79^a, pl. II, fig. 3 d), by the differently shaped and armed second tarsal joint, as well as by other marked differences.

The structure of the ovigera in the male as compared with those in the female is worthy of notice, the more complicated bending and the armature in the former being well adapted to keeping the egg-masses from slipping off. One of the males examined (collected on November 26) had a single egg-mass on one of this ovigera, while another specimen (collected September 2) was carrying eight rather bulky globules.

As mentioned above, the females are somewhat stouter than the males, and in a specimen collected on December 29 large ova were to be seen in the second and third coxal and femoral joints.

Genus *Ammonothea* Leach ('14).

Achelia HODGE, '64, p. 114.

Trunk short, stout, segmentation usually suppressed; lateral processes closely crowded, making the body appear more or less disciform; first segment massive, with square frontal part. Caudal segment not separated from last trunk segment by a suture, narrow cylindric, usually horizontal. Eye tubercle near to the front of the first segment, strongly protuberant, with distinct eyes. Proboscis directed obliquely downward, constricted at the base, fusiform, often with an annular constriction near the distal end. Chelifori in fully developed specimens very small, 2-jointed, second joint globose. The chelifori are chelate in immature specimens. Palpi 8-jointed; *j.1* and *j.3* short; *j.2* and *j.4*

¹ The numbers in this column are those given to each lot of specimens of the same species and from the same locality; the original numbers of the collectors, when there were such, are given in the column with the source.

longer. Ovigera relatively short, larger in the male than in the female; without terminal claw, but with a few denticulate spines (rarely absent, cf. *A. dohrni* Thomson, '84, p. 244). Legs usually rather short, and robust in the female; frequently spinous, usually more so in the male, especially on the basal joints; femoral joint very broad in female, the outer corner more or less projecting in both sexes; second tarsal joint strongly developed, more or less curved, and with a few strong and several weaker spines on the inner margin; terminal claw strong; auxiliary claws usually well developed. Genital openings of female on second coxal joint of all 4 pairs of legs; those of the male at the apex of prominent projections on the corresponding joints of the third and fourth pairs of legs only.

Remarks.—The genus *Ammothea* was first established by Leach to include certain forms having chelate chelifori; later Hodge gave the name *Achelua* to some very similar Pycnogonids, which had, however, rudimentary 2-jointed chelifori; but Dohrn ('81, p. 134) and others since have shown conclusively that *Achelua* represents merely the fully developed individuals of *Ammothea*. Dohrn believes that the following genera—*Phanodemus* Costa, *Pephrado* Goodsir, *Pasithoe*¹ Goodsir, *Endeis* Philippi, *Puribwa* Philippi, *Platychelus* Costa, and *Alcinous* Costa—should also be considered as synonyms of this genus.

It is possible that *A. longicaudata* Stimpson is identical with one of the species described here, and if so it is probably with *A. latifrons*. (See 'Remarks' under that species, p. 266.)

I have been unable to examine the description of *A. borealis* given by Schimkewitsch ('95) in a paper on the Pycnogonida of the White Sea, in order to compare with it the forms collected in Alaska, so that there remains a possibility that one of these may be the same as that described by him.²

AMMOTHEA LATIFRONS sp. nov.

Plate XI, fig. 3; plate XVI, figs. 1-9; plate XVII, figs. 1-3.

Type.—♂ and ♀, University of California, No. 19,503, St. Paul Island, Bering Sea.

Trunk broad, especially anteriorly, each outer corner having an erect conical protuberance armed with a few spines, short, tapering posteriorly in a V-shape, smooth; sutures indistinct anteriorly, obsolete posteriorly; lateral processes very closely crowded, nearly twice as broad distally,

¹ Sars ('91, p. 137) considers *Pasithoe* as probably distinct, and uses it as the type of a family, the Pasithoide, including with it one other genus, *Colossendeis*.

² Subsequent comparison with Schimkewitsch's description shows that *A. borealis* is distinct from the species described in this paper.

where there are on the dorsal border three nodular processes, each armed with one or more spines.

Caudal segment very long and narrow (as long as proboscis), reaching a little beyond the middle of the second coxal joint of the posterior pair of legs; not marked off from trunk by a suture; directed somewhat downward; dorsal outline irregular and armed with a number of stout spines.

Eye tubercle on the extreme anterior edge of the first trunk segment, moderately high, cylindrical; apex obtusely conical; eyes rather large, near the apex.

Proboscis about as long as trunk to base of caudal segment, broadly elliptical, truncated at the extremity; dorsal border more convex than ventral as seen from side; without circular constriction, but with distinct longitudinal ribs.

Chelifori considerably over half the length of the proboscis, stout; first joint reaching at least to middle of proboscis; tuberculated on the dorsal side, the tubercles armed with spines; second joint small, spherical, with 1 or 2 spines. The chelifori are not parallel, being bowed outward in the middle.

Palpi 8-jointed, overreaching the proboscis by nearly a third of its length; *j.2* and *j.4* long, others short; *j.2* somewhat longer than *j.4*, proximal joints sparsely armed with a few rather long bristles; outer side of distal joints densely crowded with somewhat shorter ones.

Oviger a considerably different in the two sexes. Oviger of female about as long as palp; *j.1* short and broad; *j.2* issuing somewhat from the side of *j.1*; *jj.2* and 3 about equal, longer than *j.1*; *jj.4* and 5 about equal, longest; *jj.6* to 10 successively smaller; *j.10* very small, rounded; *jj.7*, 8, 9, 10 each armed with two denticulate spines; *jj.5* and 6 with a few small bristles. Oviger of male nearly twice as long as that of female; *j.1* squarish; *j.2* longer than *j.1*; both *jj.1* and 2 broader than the succeeding joints; *j.3* longer than *j.2*; *j.4* and *j.5* about equal, longer than *j.3*; *jj.6* to 10 successively smaller, except *j.9*, which is longer than *j.8*; *j.10* small and furnished with 2 denticulate spines, while *j.9* has at least 1; no denticulate spines could be discerned on the preceding joints. Joints 4 to 7 are armed with short, backwardly projecting spines in rows, while the succeeding joints have only 2 or 3 simple bristles each. Terminal part of the oviger strongly incurved.

External egg-masses rather small, globular. So far as observed, but one mass on each oviger.

Legs relatively short, rather less than twice the length of the body; *c.2* not much longer than *c.1* and *c.3*; *c.1* with 3 tubercles on its dorsodistal edge, each armed with spines; *f.* rather shorter than coxal region,

especially broad in the female, where it may equal the width of the proboscis; at the dorsodistal border is a long conical protuberance armed with a strong spine which usually projects distally; *t.1* and *t.2* equal, stout; all these joints armed more or less densely with moderate spines, which are longer, however, on the dorsal side of *t.1* and *t.2*. First tarsal joint small, subtriangular, with short, even spines; *ts.2* moderately strong, arcuate, armed dorsally and on the sides with rows of slender spines, and ventrally with 3 strong spines at the heel and a row of very short ones along the sole; *cl.* about one half *ts.2.*; *aux. cl.* well developed, half as long as *cl.* In the male the genital projection on the ventrodiscal side of *c.2* of the 2 posterior pairs of legs is pronounced and thumb-like, and provided with 1 or 2 slender bristles. As is characteristic of the genus, the genital openings of the female are in a corresponding position on all 4 pairs of legs, but are not situated on similar protuberances.

Length about 4 mm., extent 16 mm.; the two sexes nearly the same size.

Immature specimens.—Four immature specimens of this species were examined, two from each locality where the form was taken. They are but little smaller than the adults, which they closely resemble, but are provided with chelate chelifori (pl. xvii, fig. 1), and the ovigera are very short, with indistinct articulations (fig. 2). It is interesting to note that the denticulate spines are already forming in this early stage, in a space beneath the outer cuticle (fig. 3), and at the next moult would probably be free. If any of these specimens were males there was no trace at this stage of the genital protuberances; in fact, the genital openings were not distinguishable at all.

SPECIMENS EXAMINED.

Lot.	Locality.	No. of specimens.	Date.	Source.
1	St. Paul Island, Pribilofs	2♂, 3♀, 2 juv.	1897	Prof. Kincaid (123)
4	Dutch Harbor, Unalaska	1♂, 3♀, 2 juv.	July, 1899	H. A. E. (Prof. W. R. Coe)

Remarks.—Whereas *Ammotheca alaskensis* may be taken as the representative of *A. levis* (Hodge) in the Western Hemisphere, *A. latifrons* more closely approaches those forms grouped about the European species *A. echinata* (Hodge). It may readily be distinguished from any described species, however, by its very broadly elliptical proboscis and the long, knobby chelifori and caudal segment. This species is about twice the size of *A. echinata*.

The description of *Ammothea longicaudata* Stimpson ('64, p. 159) will apply in most respects to *A. latifrons*, but the description is so generic that it would apply almost equally well to a number of other species. Furthermore, Stimpson's single example was evidently an immature specimen, and if, as he says, the palpi were 9-jointed,¹ it is not unlikely that it belongs properly in the genus *Ammothella*. On the whole it seems best to regard it as a distinct species until further material from the region of Puget Sound shall enable us to settle the question.

All the specimens of *A. latifrons* had a quantity of foreign material entangled in the spines; those in the lot from Dutch Harbor especially were covered with this débris, containing, among other things, small brownish stalked bodies (similar ones are not infrequent on Pycnogonida) and groups of small cases appearing much like egg-cases of some animals, possibly the same as those referred to by Hoek ('81^a, p. 143).

AMMOTHEA ALASKENSIS sp. nov.

Plate XII, fig. 4; plate XVII, figs. 4-12.

Type.— ♂ and ♀, University of California, No. 19,505, Orca, Alaska.

Trunk short, stout, smooth; sutures very indistinct; first segment square in front, affording a broad attachment for the chelifori and palpi; lateral processes about equal to width of body, larger distally, and closely approximated, so that the body appears nearly circular in outline; a small protuberance with a short spine on the dorsal side of each process near the distal end.

Caudal segment long, narrow, somewhat smaller proximally, reaching to about the middle of the first coxal joint of the posterior pair of legs; with 3 or 4 small spines near the apex and a large bristle on the dorsal side.

Eye tubercle low, conical; the posterior side more slanting and with more of a 'hip.' Eyes large, at about the middle of the tubercle; no noticeable difference in size.

Proboscis about as long as trunk to base of caudal segment, distinctly fusiform in dorsoventral view, strongly convex on dorsal side and more nearly straight on ventral when viewed laterally; with a more or less irregular annular constriction about a fourth of its length from the apex.

Chelifori considerably less than half the length of the proboscis; first joint with a considerable triangular projection distally on the dorsal side, terminating in a small bristle; second joint small, globular, arising some-

¹ "Chelate 'antennæ' much shorter than the proboscis; their slender lower branch, however, is much longer, nine jointed, not tapering, and with blunt extremity" (*loc. cit.*).

what from the inner side of the first. Both joints unarmed, except as noted above.

Palpi 8-jointed, longer than proboscis: *j.1* short and broad, and apt not to be seen when the animal is viewed from above; *j.2* much longer and more slender, enlarging somewhat distally; *j.3* short and small; *j.4* about equal to *j.2*; *jj.5* to 8 small, rounded, rather densely armed on the ventral side with strong bristles; the preceding joints with only 2 or 3 bristles.

Oviger of female about as long as palpi: *j.1* short, broad, longer on inner side; *j.2* longer, arising well down on the outer side of *j.1*, triangular, broad at the distal end; *j.3* equals *j.1*; *j.4* somewhat longer, about equals *j.2*; *j.5* equals *j.4*, broader; *jj. 6, 7, 8, 9, 10* are usually turned back on the basal joints so that the appendage forms a simple hook; the diameter gradually decreases from *j.5* to *j.10*; *jj.6, 7, 8* rounded; *j.9* longer; *j.10* very small and not always very distinctly marked off. The tenth joint is armed with 2 feather-like denticulate spines; there are apparently¹ 2 also on each *j.9* and *j.8*, while there is at least 1 on *j.7*. Joint 9 has a strong, straight, backwardly pointing spine on the dorsal side; on the other distal joints there are a few short, simple spines; the proximal part is unarmed. Oviger of male about twice the size of that of the female; the general form of the joints much the same, except that they are much longer in proportion to the width; arrangement of denticulate spines about as in female; corresponding long spine on back of *j.9*; but *jj.4* to 8 have quite a number of long slender bristles, which are especially abundant on the outer side of *j.6*. There is also a row of some 8 or 9 short, stout, recurved spines on the side of *j.5*, while the proximal joints of the oviger have more of a tendency to be hairy than in the female. Terminal part of oviger strongly incurved.

Ova were observed in the femoral joint of the female, but no external egg-masses were found.

Legs comparatively rather stout, appearing especially so in the female, where the femoral joint is very broad. First coxal joint short, with a long, slender dorsal protuberance; *c.2* only a little longer than *c.1*; *c.3* equals *c.1*; *f. 1.1*, and *1.2* each about equal in length to coxal region; *f.* has at its dorsodistal corner a conical protuberance with a short spine; *1.1* small, triangular; *1.2* strongly developed, somewhat arched; heel not prominent, but there are 3 or 4 strong spines at this place; sole with a series of smaller spines, while there is a row of more slender

¹The margins of these spines are so delicate and thin that when they chance to lie over or under the appendage on the slide it is exceedingly difficult to distinguish them from ordinary simple spines.

bristles along the dorsal curve; *cl.* strong, fully half as long as *ts.2*, but slightly curved; *aux. cl.* well developed, half as long as *cl.* Legs of female nearly smooth, a few small bristles, especially on the dorsal side of *f.*, *t.1*, and *t.2*; male considerably more spiny, especially on coxal joints.

Length of male about 3 mm., extent about 13 mm.; female slightly smaller.

As shown in the following table, the localities at which this species was taken were two—Orca, in Prince William Sound, and Popof Island, in the Shumagin group. Those at Orca were found on *Thuiaria turgida* Clark.¹

SPECIMENS EXAMINED.

Lot.	Locality.	No. of specimens.	Date.	Source.
6	Popof Id., Alaska	1 ♀	July, 1899	H. A. E. (Prof. Kincaid) (113)
7	Popof Id., Alaska	1 ♀	July 8, 1899	H. A. E. (Prof. W. E. Ritter)
25	Orca, Alaska	1 ♂, 1 ♀	June, 1899	H. A. E.

Remarks.—This species resembles *Ammotheca laevis* (Hodge) as described by Sars ('91, p. 124, pl. XIII, fig. 2, a–m), especially in lacking the very spiny character of many of the species of the genus. It appears, however, to be distinct from *A. laevis*. Among other differences may be noted the following: *A. alaskensis* has but one protuberance on the lateral processes, in place of two; the eye tubercle is much smaller, with the eyes of the same size; the proboscis is considerably larger in proportion and of a different shape; the chelifori are not half as long as the proboscis, and the basal joint has a prominent dorsal process; the second joint of the palpi is not shorter than the fourth; the auxiliary claws are much better developed. *A. alaskensis* is also about twice the size of *A. laevis*.

No immature specimens of *A. alaskensis* were found.

Rather thickly scattered over the surface of one of the specimens from Orca, and especially on the palpi, was observed a peculiar elliptical diatom, and it was of interest that the same form was found on one of the specimens from Popof Island, some six or seven hundred miles to the westward. Two or three other species of diatoms were also clinging to the latter. The first-mentioned diatom has also been observed on other species of Pycnogonida.

¹ I am indebted to Professor C. C. Nutting for the identification of this Hydroid.

AMMOTHEA GRACILIPES sp. nov.

Plate XII, fig. 5; plate XVIII, figs. 1-6.

Type.—♂ and ♀, University of California, No. 19,506, Lands End, San Francisco County, California.

Trunk rather broad, tapering rather abruptly behind the third lateral processes, smooth, broader anteriorly, where the lateral corners are produced into rounded, unarmed tubercles; sutures indistinct; lateral processes close together, about as long as breadth of trunk, even with second pair, abruptly narrowed in proximal half, and with a small dorsal tubercle at the distal end.

Caudal segment moderately long, reaching at least to the end of the first coxal joint of the fourth legs, curved upward, and usually somewhat bifid as seen in lateral view; smooth.

Eye tubercle short, bluntly conical, and but slightly hipped. Eyes rather large; at base.

Proboscis about as long as trunk to base of caudal segment; rather narrow as seen from above and broadest at about the middle; from the side, broadest beyond the middle and more nearly straight on ventral side.

Chelifori somewhat less than half the length of the proboscis; scape short and thick, produced into a small dorsal tubercle at the distal end; second joint about half as long as scape, oval.

Palpi 8-jointed, but little longer than the proboscis; *jj*.1 and 3 short; *jj*.2 and 4 long, equal; *jj*.5, 6, 7, 8 short, rounded, bulging somewhat ventrally, where each is armed rather densely with short bristles; first four joints nearly unarmed.

Ovigeras of female about as long as palpi; *j*.1 short, square; *j*.2 longer; *j*.3 equal to *j*.1; *j*.4 as long as *j*.2, broader distally; *j*.5 longest; *j*.6 smaller than *j*.7; *jj*.8 and 9 successively smaller; *j*.10 very minute; *jj*.7, 8, 9, 10 each provided with a pair of denticulate spines; aside from this the appendage is practically unarmed. Ovigeras of male about one and three fourth times as long as that of female; *j*.1 short and thick; *j*.2 twice as long but of the same diameter; *j*.3 still longer, narrower; *j*.4 slightly shorter than *j*.3; *jj*. 5 and 6 about equal, each about as long as *j*.1; *j*.7 projecting somewhat at its outer distal corner; *j*.8 small; *j*.9 slightly longer; *j*.10 minute. The only denticulate spines distinguished were two on *j*.10. The third joint and those comprising the terminal part of the oviger have a few scattered bristles along the side of greater curvature, while *j*.7 has a clump of 4 or 5 at its distal end.

Eggs relatively large (about 0.13 mm. in diameter), in small balls with

6 or 8 eggs in a ball; the male may have from 10 to 15 of these masses on each oviger.

Legs about twice as long as body, rather slender, especially in the male; *c.1* with an especially long finger-like projection on its dorsal side, nearly as long as the joint itself; *c.2* about half again as long as *c.1*; *c.3* equals *c.1*; *f.* broader in the female, with the conical projection and spine characteristic of the genus at its distal end; *t.1* and *t.2* each about equal to *f.*, outer border uneven and armed with scattering short spines; *ts.1* nearly unarmed; *ts.2* large and stout, nearly as long as *t.2*, well arched, with a few small spines on the dorsal side; heel with 3 rather strong, distally curved spines; a row of short, slender spines along the sole beyond it; *cl.* stout and but little curved, half as long as *ts.2*; *aux. cl.* well developed, half as long as *cl.* Except as mentioned, the leg is almost free of armature; there are a few short spines on *c.2* and *c.3*.

Length 1.5 mm. to 2 mm.; extent about 8 mm.

SPECIMENS EXAMINED.

Lot.	Locality.	No. of specimens.	Date.	Source.
9	Lands End, San Francisco Co., Calif.	2 ♂, 1 ♀	Feb. 8, 1899	Univ. of Calif.
12	Oakland Creek, Calif.	2 ♂, 20 juv.	March, 1899	Univ. of Calif.

Remarks.—The present species of *Ammotheca* was much the smallest representative of the genus in the collections. In size it compares with *A. echinata* of Europe. This species is described from the 3 specimens from Lands End (Lot 9); the specimens from Oakland Creek (Lot 12) differ slightly from these, but with the material at hand it did not seem advisable to separate them as a subspecies. The process on the first coxal joint is not so long, while the chelifori and caudal segments are apparently a little longer in proportion. With Lot 12 there are 20 immature specimens in various stages of development, and all with chelate chelifori.

There were two species of Hydroids in the bottle with Lot 12, among which the Pycnogonids were probably collected. These were identified by Professor Nutting, one as *Obelia dichotoma*, the other as *Obelia gelatinosa* or a closely related species.

AMMOTHEA PRIBILOFENSIS sp. nov.

Plate XII, fig. 6; plate XVIII, figs. 7 and 8; plate XIX, figs. 1–8.

Type.—♂ and ♀, University of California, No. 19,507, St. Paul Island, Bering Sea.

Trunk broad, not markedly tapering posteriorly, unarmed; antero-

lateral corners produced, rounded, smooth; sutures indistinct; lateral processes crowded, about as long as breadth of trunk in median part, much broader distally, where they have on the dorsal border two small tubercles which bear a few short bristles. On the first lateral process one of these tubercles is usually much reduced (pl. XIX, fig. 2).

Caudal segment moderately long, reaching to the posterior border of the first coxal joint of the fourth pair of legs, narrow, curved slightly upward, and continued more or less into an upward projection at the tip; possessing a few minute bristles.

Eye tubercle slightly back from the anterior margin of the first trunk segment, moderately high, sharply pointed, nearly straight on the anterior border, sloping and with a slight hip posteriorly. Eyes dark; at the base of the tubercle.

Proboscis large, equal in length to femoral joint of leg, broadly clavate, truncate at the apex, usually bent far over so as to be directed downward; roughly triangular in section, thus appearing from the side much more convex on the dorsal border. Without circular constriction.

Chelifori barely one third as long as proboscis; scape short and comparatively thick, produced dorsally at the distal end into a considerable projection; second joint nearly half as long as first, elliptical. The cheliforus is unarmed except for a few very short bristles at the end of the scape.

Palpi 8-jointed; when fully extended distal 4 joints reaching beyond the proboscis; *jj*.1 and 3 short; *jj*.2 and 4 long, equal; *jj*.5, 6, 7, 8 short, the first three of these triangular, being much broader at the distal end, the next distal joint in each case articulating at the dorsal side, thus leaving a rounded projection below, which is bristly with short spines; *j*.8 elliptical, similarly armed. Joints 2 and 3 have a few rather stout bristles at their distal ends, and a row of similar bristles extends along the dorsal side of *j*.4.

Oviger of female about as long as palpi: *j*.1 short and broad; *j*.3 short; *jj*.2, 4, and 5 longer and broader than *j*.3; *jj*. 6 to 10 gradually diminishing in size; *jj*.7 to 10, at least, with two denticulate spines each; appendage otherwise unarmed except for a few scattered minute spines. Oviger of male nearly twice as long as that of female; *j*.1 short, broad; *j*.2 two or three times as long, also broad; *jj*.3 and 4 somewhat longer than *j*.2, but more slender; *j*.5 nearly as long as *j*.4, broader again; *j*.6 shorter, about as broad as *j*.5; *jj*.7 to 10 decrease gradually in size and diameter, except that *j*.9 is longer than *j*.8. Denticulate spines, two in number, were observed only on *j*.10. The terminal part of the oviger is turned sharply inward and curved back upon itself.

Joints 3 to 8 are provided, mostly on the outer curve, with rather long, closely set bristles, which tend to turn backward for the most part, except on *j.3*.

Eggs carried by the male in numerous small pear-shaped masses, which are attached to the ovigera by short thread-like stalks. One male may carry between 30 and 40 of these masses, in each of which there are relatively few eggs.

Legs about twice as long as body: *c.1* short, square, provided on the dorsodistal border with a strong median protuberance which has on each side of it a smaller projection bearing a few short bristles and forming the outer corners of the joint (pl. XIX, fig. 2); *c.2* nearly twice as long as *c.1*, bearing in the male on the third and fourth legs, in the usual position, a long thumb-like genital projection, about half as long as the joint from which it arises, considerably broader distally than proximally, and rather thickly beset with long slender bristles; *c.3* shorter again. Femoral joint about equal to coxal region, of the usual shape, much broader in the female and with a rounded protuberance distally on the dorsal edge; *f.1* and *f.2* about equal to each other and to *f.* in length, but of smaller diameter than the last; *ts.1* small, triangular, rounded below; *ts.2* stout, over half as long as *f.2*, rather strongly arcuate; heel hardly differentiated, but there are 3 rather strong, distally curved spines at this point; sole armed with comparatively long, thickly set bristles which extend back on to the heel (fig. 5). Claw about half as long as *ts.2*, but slightly curved; *aux. cl.* well developed, half as long as *cl.* All the joints beyond *c.1* beset with more or less scattered short bristles; these are considerably longer and thickly crowded on the ventral side of *c.3* and the proximal end of *f.*

Length 6 mm. to 7 mm., extent fully 30 mm.; the two sexes about the same size.

Color in alcohol yellow to dark brown. Integument thick; cuticular cavities large and numerous.

Immature specimen.—There was with Lot 2 one immature specimen, about two thirds the size of the adult animals, and with chelate chelifori; the chelæ rather stout and strongly forcipate (fig. 3). The ovigera were small and undeveloped.

SPECIMENS EXAMINED.

Lot.	Locality.	No. of specimens.	Date.	Source.
2	St. Paul Island, Pribilofs	2♂, 3♀, 1 juv.	Aug. 10, 1897	Prof. Kincaid (121)
23	St. Paul Island, Pribilofs	1♂	1897	Prof. Kincaid (123)

Remarks.—As shown in the table above, this remarkably large representative of the genus *Ammothea* has been found only at St. Paul Island, presumably in shallow water. Besides by its large size, it may be distinguished by its relatively very large and peculiarly shaped proboscis, the nearest approach to which would seem to be found in this genus in *A. magniceps* Thomson ('84, p. 244, pl. xv, figs. 1-5, and pl. xvi, fig. 3).

Genus *Ammothella* (Verrill).

Ammothea (in part).

Ammothella (subgenus) VERRILL, :00, p. 581.

Similar in most respects to *Ammothea*, from which it differs principally in the fact that the trunk is usually proportionately broader and distinctly segmented, the chelifori 3-jointed,¹ and the palpi 9-jointed (sometimes 10-jointed?), while the femoral joint lacks the projection at its distal and always present in *Ammothea* proper.

Remarks.—Dohrn ('81) described three species of Pycnogonida from the vicinity of Naples which present the characters outlined above, but he included them all in the genus *Ammothea*. Recently Verrill (:00, p. 581) has reported a species from the Bermudas which is very insufficiently described, but which agrees with the forms reported by Dohrn except that, according to Verrill, the Bermuda specimen has 10-jointed palpi. Verrill named his specimen "*Ammothea* (?) *rugulosa*," and, evidently because it differed from typical *Ammothea* in the number of joints in the palpi, made a new subgenus for it which he called *Ammothella*. From a study of the specimens described in this paper I believe that they, together with Verrill's species and the three species *A. appendiculata*, *A. uni-unguiculata* and *A. bi-unguiculata* of Dohrn may properly be put into a genus distinct from the restricted *Ammothea*, and to this I give the name *Ammothella* proposed as a subgeneric name by Verrill.

AMMOTHELLA TUBERCULATA sp. nov.

Plate XII, fig. 7; plate XX, figs. 1-6.

Type.—♀, University of California, No. 19,508, Northern California.

Trunk broad, elliptical, segmentation clearly marked; anterior corners produced into short rounded tubercles; the first, second, and third segments each with a conical tubercle dorsally near its posterior border (this was lacking on the third segment in one of the specimens, Lot 22), anterior of these tallest, decreasing in height posteriorly; lateral processes short, only half as long as breadth of trunk, closely crowded, somewhat broader

¹ Dohrn ('81, p. 154) considers the chelifori 2-jointed and explains the 3-jointed appearance by saying: "Sie ist auf weit ausgezogenen Basalstücken eingelenkt."

distally, where the dorsal corners are continued into 2 short, knob-like processes.

Caudal segment moderately long, curved slightly upward, reaching slightly past the middle of the second coxal joint of the fourth pair of legs; narrow, swollen distally, slightly bifid at the apex as seen from above; armed with a few short bristles and a longer one on the dorsal side.

Eye tubercle moderate, taller than the dorsal tubercles, bluntly rounded. Eyes of good size; near the apex.

Proboscis equals trunk to base of caudal segment, broadly ovate, somewhat narrower in side view.

Cheliferi over half as long as proboscis; second joint about equal to first, clavate, with a number of short bristles at its distal end; third joint short, less than half as long as second, subchelate, the somewhat triangular pieces representing the fingers of the chela probably being the rudiments of those organs in the larva. The third joint has one short spine.

Palpi 9-jointed; when fully extended but little longer than the proboscis, about 3 joints reaching beyond its tip; *jj.1* and 3 short; *jj.2* and 4 longer; *j.2* somewhat longer than *j.4*; *jj.5* to 9 short and decreasing gradually in size, subtriangular, being bulged ventrally toward their distal ends, and here armed with numerous short bristles. The fourth joint has scattered similar bristles; the remaining (basal) joints practically unarmed.

Ovigeras of the female equal to the palpi in length; *j.1* short; *j.2* longer; *j.3* shorter again; *jj.4* and 5 longest, each about equal to *j.1 + j.2*; *jj.6*, 7, and 8 successively smaller; *j.9* larger again, about equal to *j.7*; *j.10* very small, and armed with 2 denticulate spines, as is also the case with *j.9* and *j.8*. Aside from this the appendage is almost unarmed, except for 3 or 4 short curved spines on *j.6*.

Legs stout, somewhat less than twice as long as body; *c.1* short, square, with a short rounded protuberance dorsally; *c.2* longer, considerably narrower at proximal end, where it joins *c.1*, somewhat bulged distally below; *c.3* equals *c.1*; *f.* comparatively short and broad, without the thumb-like protuberance at the distal end usual in *Ammonothea*, but with several bristles at this point and scattered along its dorsal border; shorter than coxal region; *t.1* and *t.2* each about equal to *f.*, both with more or less wavy dorsal borders, where they have a row of bristles of irregular size; *ts.1* not unusual, armed with a few small bristles, especially ventrally; *ts.2* equals about four fifths of *t.2*, rather stout, but slightly arcuate; with a row of small bristles dorsally, 3 stout spines on the heel, and a row of short slender spines along the sole. Claw half as long as *ts.2*, rather strongly curved; *aux. cl.* about half as long as *cl.*

Length of female 1.8 mm., extent about 9.5 mm.

Color in alcohol light yellowish. General appearance clean and smooth.

SPECIMENS EXAMINED.

Lot.	Locality.	No. of specimens.	Date.	Source.
22	"Northern California" Dillon's Beach, Sonoma Co., Calif.	1 ♀	1893	Dr. S. J. Holmes
27		1 ♀	Nov. 26, 1898	Univ. of Calif.

Remarks.—Both of the specimens at hand were females; in one ova could be distinguished in the second and third coxal and femoral joints of the legs, while in the other the character of the ovigera and the fact that genital openings could be plainly distinguished in the usual place on all four pairs of legs left no doubt of its sex.

AMMOTHELLA SPINIFERA sp. nov.

Plate XII, fig. 8; plate XX, figs. 7-9; plate XXI, figs. 1-6.

Type.—♀, University of California, No. 19,509, San Diego, California.

Trunk broad, not especially tapering, the outer anterior corners without prominent protuberances; segmentation distinct; 1 or 2 short spines at the base of the eye tubercle, and a longer one on each side of the mid-dorsal line on the posterior border of the first and second segments. Lateral processes well separated, comparatively short, about half as long as breadth of body at second segment, somewhat swollen distally, with a short spine dorsodistally and usually one to each side on the distal border.

Caudal segment long, slender, about equal to first 2 trunk segments, projecting upward at an angle of about 45°, slightly arched; armed with several slender spines, those on the dorsal border especially long.

Eye tubercle narrow, high, erect; about two thirds as long as caudal segment, with a sharp angle or hip on each side as seen in antero-posterior profile; eyes large, dark, situated at the tip of the tubercle.

Proboscis about as long as trunk, rather broadly fusiform, as broad as trunk between the first and second lateral processes.

Chelifori long, reaching to within a short distance of the tip of the proboscis; first joint nearly as long as second; second joint clavate; both this and the first armed with a few short spines. Terminal joint small, rounded, bituberculate, showing evidence of its former chelate condition; armed with 1 or 2 short spines.

Palpi 9-jointed, fully half again as long as proboscis: *jj.* 1 and 3 short;

jj.2 and 4 longer, *j.4* being longer than *j.2*; *j.5* longer than *j.3*, about half as long as *j.2*; *j.6* longer than *j.5*, fully half as long as *j.4*; *j.7* small, shorter than *j.5*; *j.8* slightly longer than *j.7*; *j.9* longer than *j.8*; *jj.5*, 6, 7, 8 somewhat clavate, the succeeding joint being in each case articulated at the dorsal side of the broad distal end of the joint preceding it. The palp is armed with short, rather stout spines, especially along the ventral side of the distal 5 joints.

Oviger of female measures somewhat less than fully extended palp: *j.1* short; *j.2* considerably longer; *j.3* slightly longer than *j.1*; *j.4* longest, about twice as long as *j.3*; *j.5* shorter again; *j.6* still shorter; *j.7* longer than *j.6* but shorter than *j.5*; *j.8* about equal to *j.6*; *j.9* about equal to *j.7*; *j.10* very small, rounded. Joint 10 has two rather large denticulate spines, *j.9* at least one, and *j.8* two smaller ones; besides this the terminal joints of the oviger may bear 1 or 2 short simple spines, while the remainder of the appendage is unarmed.

Legs about twice as long as body; *c.1* short, armed distally with 1 to 3 or 4 short, stout spines; *c.2* about twice as long as *c.1*, considerably broader distally; *c.3* about as large as *c.2*; *f.* about as long as coxal region, but little broader than *c.3*, and without a projection dorsodistally; *t.1* equals *f.*; *t.2* somewhat longer; both with a more or less irregular wavy dorsal margin; *ts.1* rather long in proportion to its breadth, terminating dorsally in a well-marked 'lappet'; *ts.2* somewhat less than half as long and nearly as broad as *t.2*, of about the same width throughout, and slightly arcuate; armed dorsally with 5 or 6 long slender spines and several shorter ones; heel with 3 short stout spines which project slightly distally; sole with a comb-like series of much shorter spines; *cl.* less than half as long as *ts.2*, the dorsal surface curved about evenly, the ventral straight proximally and curved near the tip; *aux. cl.* over half as long as *cl.*, slender.

Length 1.8 mm., extent about 8 mm.

Specimens of a dark brownish color, due chiefly to adhering dirt; light brown when this is removed. Integument thin and cuticular cavities scattered.

Immature specimen nearly as large as adults, more slender; chelifori chelate (pl. XXI, fig. 4); chelæ slender, strongly curved, crossing one another at tip; ovigera short, not fully developed.

SPECIMENS EXAMINED.

Lot.	Locality.	No. of specimens.	Date.	Source.
14	San Diego, Calif.	2 ♀, 1 juv.	July 8, 1895	Dr. S. J. Holmes (236)

Remarks.—The 3-jointed chelifori, the 9-jointed palpi, and the absence of a marked protuberance on the dorsodistal extremity of the femoral joint clearly relate this form to *A. tuberculata*, and to those forms which I have placed with it in the genus *Ammothella*, viz., three species from the Gulf of Naples (see 'Remarks,' p. 273).

The two mature specimens of this lot were both females with ova in various stages of development in the second and third coxal and femoral joints of the legs.

The species is well characterized by the long eye tubercle and the longer, spiny, elevated, and curved caudal segment, the spines on the dorsal surface of the body, and the long, slender spines of the legs.

Genus *Tanystylum* Miers ('79).

Trunk broad; lateral processes comparatively short and closely crowded, making the body disciform; segmentation suppressed. Chelifori usually mere 1-jointed knobs; sometimes 2-jointed; chelate in immature specimens. Palpi with 6 or 7 joints; first and third joints short, second and fourth longer. Femoral joint of legs of female considerably swollen. Openings of oviducts in usual position on all four legs. Openings of the genital ducts of the male not upon genital protuberances.

Remarks.—The genus *Tanystylum* is undoubtedly very closely related to *Ammothea*, but differs in several important respects. I was at first inclined to include *Clotenia* with this genus, as Schimkewitsch has done (Schimkewitsch, '89), but in view of the highly concentrated body,¹ closely approximated eye tubercle and caudal segment, 4-jointed palpi, and male genital openings in the second as well as the third and fourth pairs of legs, I think it may well be left, for the present at least, as a separate genus.

The species which I have here called *Tanystylum intermedium* differs from previously described species of the genus in having 2-jointed chelifori, and from all but *T. chierchie* Schimkewitsch ('89, p. 333) in having 7-jointed palpi instead of 6-jointed. It is, however, so similar in other respects that a separation into another genus does not seem justifiable.

Discoarachne brevipes Hoek ('81a, p. 74) is undoubtedly very closely related to the forms under discussion, and perhaps should be classed as a species of *Tanystylum*.

¹ Dohrn ('81, p. 162) well says: "Dieses Thier [*Clotenia conirostris*] hat die bei weitem concentrirteste Gestalt aller Pantopoden, die ich kenne."

TANYSTYLUM INTERMEDIUM sp. nov.

Plate XXI, figs. 7-9; plate XXII, figs. 1-7; plate XXIII, figs. 1-3.

Type.—♂ and ♀, University of California, No. 19,510, San Diego, California.

Trunk broad, segmentation not evident; the anterior border with the outer corners each produced into a prominent tubercle which bears a spine. Lateral processes not so long as width of body, wedge-shaped and closely crowded, the outline of their outer borders, together with the anterior border of the trunk, making a complete circle; first, second, and third pairs with a dorsal tubercle near the distal end, shorter and rounded in the female, longer, more pointed, and terminated by a short bristle in the male.

Caudal segment moderate, reaching to about the middle of the second coxal joint of the fourth pair of legs; rather narrow, about half as broad as basal joint of leg; diameter somewhat larger distally than proximally as seen from above; directed obliquely upward at less than 45° ; smooth, apex rounded.

Eye tubercle moderate, rather thick, blunt; situated at the extreme anterior end of the first trunk segment and directed forward at about the same angle that the caudal segment projects backward. Eyes rather large, dark; posterior pair apparently the larger.

Proboscis pyriform, being widest a third of its length from the base and tapering to a more or less truncated tip; usually directed somewhat downward; about as long as trunk from its anterior border to the distal end of the fourth pair of lateral processes. In side view nearly straight on ventral side; dorsal side strongly convex.

Chelifori 2-jointed, very short, about one fourth as long as proboscis; first joint about twice as long as broad, slightly curved, with a small tubercle and a short spine near the distal end; second joint very small, rounded, divided into two parts by a groove, showing the former presence of chelæ. The second joint also bears a short spine.

Palpi 7-jointed, rather stout, slightly overreaching the proboscis (by the terminal joint). First and third joints short; *j.2* and *j.4* longer, *j.2* longer than *j.4*; *jj.5*, 6, and 7 successively smaller. These 3 joints with a considerable number of short bristles or hairs; other joints with a few scattered ones, *j.2* having a somewhat stronger one on its outer distal corner.

Oviger of female slender, about equal in length to the palp. First 3 joints short and of about the same length; *jj.4* and 5 longest; the suc-

ceeding joints smaller (not successively); *j*.10 very small. The tenth joint is armed with two rather long, curved, denticulate (?) spines; the 1 or 2 spines on the preceding joints appear to be simple. Ovipositor of the male about half as long again as that of the female; proportionate size of joints nearly the same, but *jj*.8, 9, and 10 turn inward (or downward if the appendage is carried in a horizontal position, as in fig. 7, pl. XXI) upon *j*.7, and the preceding joints at nearly a right angle. The joints of the terminal part of the ovipositor are armed with a few short, slender, simple spines.

Legs about twice as long as body: *c*.1 short, with a spine-bearing process on each of the distal dorsolateral corners; the male with an additional similar projection on the mid-dorsal line between these. The tubercles are also longer and sharper in the male. Second coxal joint a little longer than *c*.1, broader distally; *c*.3 shorter again; *f*. equal in length to coxal region, gradually increasing in breadth distally, where it ends in a triangular projection terminated by a short, stout spine; *f*. of female swollen, broadest in middle; *t*.1 and *t*.2 each about equal to *f*., rather slender, armed on the dorsal border with 2 or 3 long, slender bristles and a few shorter ones; ventral border of *t*.2 with a regular series of short, slender spines. First tarsal joint about as long as broad, convex ventrally, where it bears several fine bristles; with a well-marked 'lappet' dorsally. Second tarsal joint long and slender, at least five times as long as broad, nearly straight; dorsal surface with a series of spines, 2 or 3 of which are especially long and slender (about like those on *t*.1 and *t*.2); the others shorter; no distinct heel; the ventral surface furnished with a more or less regular row of about 10 short spines. In addition to what has been mentioned, the several joints of the leg have scattered short hairs or slender spines. Claw comparatively rather short, hardly half as long as *t*.2, falciform; *aux. cl.* slender, half as long as *cl*.

Length about 1.3 mm., extent slightly over 5 mm. The two sexes of about equal size.

Immature specimen.—The one immature specimen examined was about three fourths the size of the adults and more slender; otherwise it much resembled the female, especially in the character of its tubercular projections and spines. It had, however, chelate chelifori, the chelæ being large and strong.

SPECIMENS EXAMINED.

Lot.	Locality.	No. of specimens.	Date.	Source.
26	San Diego, Calif.	1 ♀,	July 8, 1895	Dr. S. J. Holmes
29	San Diego, Calif.	1 ♂, 1 ♀, 1 juv.	July 8, 1895	Dr. S. J. Holmes (236)

Remarks.—There is considerable difference between male and female in these lots with regard to the character and number of spine-bearing projections, but they are so similar in other respects that I think there can be very little doubt about their being the same species.

No egg-masses were found upon the ovigera of the male, but ova of various sizes could be seen in the third coxal and femoral joints of the legs of the females.

The peculiar structure of the ovigera of the male, the last three joints being articulated to the seventh at an angle, reminds one of the somewhat similar condition in the male of *Discoarachne* (cf. Cole, :01^b, Taf. 13, fig. 4), and strongly suggests the close relationship, and probable synonymy, of these two genera.

The character of the spines on the ovigera could not be well made out; at a medium magnification they appeared to be simple, but with a $\frac{1}{2}$ oil immersion objective the two on the tenth joint of the female showed fine lines indicating a denticulate margin. On the ninth joint of the same leg was a peculiar, flat, double-notched spine, shown in figure 3, plate XXIII.

The single female specimen of Lot 26 was almost completely covered with small stalked protozoa (*Vaginicolina*).

Genus *Clotenia* Dohrn ('81).

Trunk very short and broad, the lateral processes short and closely crowded, so that the body is concentrated and disciform; trunk segmentation suppressed. Eye tubercle set well back on first trunk segment; caudal segment well forward and pointed upward, so that the distance between it and the eye tubercle is short. Chelifori 1-jointed; palpi 4-jointed; ovigera present in both sexes, 10-jointed. Legs rather stout; openings of the male genital ducts in the usual position on the second, third, and fourth pairs of legs (Dohrn); without genital protuberances.

Remarks.—The greatly concentrated body, with the consequent nearness of the caudal segment to the eye tubercle, which is set well back, and the 4-jointed palpi, would seem to be sufficient to distinguish this genus, though it is certainly very closely related to *Tanystylum*. Dohrn makes a strong point of the fact that the genital openings of the male occur on the three posterior pairs of legs. Although there can be no doubt of the close affinity of the specimen from California to Dohrn's *Clotenia conirostris*, I was unable to confirm this point. The openings could be seen on the third and fourth pairs of legs, but on the second pair I was unable to find them.

CLOTENIA OCCIDENTALIS sp. nov.

Plate XIII, fig. 9; plate XXIII, figs. 4-8.

Type.—♂, University of California, No. 19,511, Pacific Grove, Calif.

Trunk unsegmented, smooth, short, and broad, especially in front; anterior outer corners rounded, without projecting knobs. Lateral processes short and very closely crowded, the lines between them radiating toward a common point slightly anterior to the caudal segment.

Caudal segment well forward, rather short, thick, bluntly conical, directed obliquely upward, armed on the dorsal surface with 2 or 3 short stiff spines.

Eye tubercle situated on the middle of the first trunk segment; about two thirds as high as caudal segment; conical, nearly straight and vertical anteriorly; sloping behind; thus giving, with the anteriorly directed face of the caudal segment and the dorsal part of the trunk segments between a saddle-shaped outline when seen from the side. The posterior, sloping, face of the eye tubercle is notched, or 'hipped,' just above the eyes, the portion above being a smaller cone set upon the anterior part of the larger truncated basal cone. Eyes close together.

Proboscis short and thick, barely twice as long as broad, directed straight forward, cylindrical, bluntly rounded at the apex.

Chelifori short, knob-like, connected at the base; armed distally with 2 or 3 short spines.

Palpi 4-jointed, not reaching to end of proboscis; nearly straight. Joints 1, 3, and 4 short; *j*.2 long, half as long as the entire appendage, considerably larger at its proximal end than distally; *j*.4 with several short stout spines distally; *jj*.2 and 3 each with 2 or 3 smaller ones.

Oviger of male about three and a half times as long as palp. First joint short, thick; *j*.2 longer and more slender; *j*.3 equal in length to *j*.1; *jj*.4 and 5 each about equal to, or slightly longer than, *j*.2; *j*.6 about as long as *j*.3; *j*.7 considerably smaller, coming off somewhat from the side of *j*.6; *jj*.8 and 9 slightly smaller than *j*.7; *j*.10 a very small rounded knob. The terminal part of the appendage bears a few scattered weak spines, besides 2 longer, stouter, divergent ones on *j*.10.

Legs comparatively stout, anterior pair somewhat over twice as long as body (measured from tip of proboscis to distal border of fourth pair of lateral processes); posterior legs noticeably shorter than anterior pairs. Coxal joints all short and of about equal length; *c*.1 with a more or less irregular projection distally on its anterior side, which is armed with a few short spines. Femoral joint stout, somewhat shorter than

coxal region; broader distally, where it is produced dorsally into a blunt angle armed with 1 to 2 or 3 short spines rather stouter than the others. Tibial joints both stout and about equal to *f.* in length; dorsally each has 3 swellings, one at either end and one in the middle, and the short spines are grouped in small clumps of 3 or 4 on these swellings. First tarsal joint very short and broad, armed ventrally with 1 stout spine and 2 or 3 smaller ones; *ts.2* nearly as long as *ts.1*, stout, broader proximally than distally, and moderately arched; armed dorsally with an irregular series of short bristles; the heel bears 3 stout spines, the sole a series of small ones. Claw fully half as long as *ts.2*, strong, evenly tapering, and curved; *aux. cl.* well developed, about half as long as *cl.*, rather straight. Besides the armature mentioned, there are short stiff spines scattered sparsely over all the joints of the leg.

The following measurements are approximate: length (in this case from tip of proboscis to distal border of fourth lateral processes) 1.3 mm.; extent 7 mm.; length of palp 0.45 mm.; length of oviger 1.5 mm.

SPECIMEN EXAMINED.

Lot.	Locality.	No. of specimens.	Date.	Source.
16	Pacific Grove, Calif.	1 ♂	Dec. 30, 1896	Univ. of Calif.

Remarks.—This species was, unfortunately, represented by only a single specimen, which, however, is distinct from *C. conirostris* Dohrn, as may be seen by the blunt, cylindrical proboscis, the shorter, more rounded caudal segment, the processes on the anterior sides of the first coxal joints, and other details.

Each of the ovigera carried a small irregular rounded egg-mass containing probably 50 to 60 eggs. The ovigera were thrust through the masses eccentrically, so that the bulk of the mass lay to one side.

Family PHOXICHILIDIIDÆ.

Chelifori present, chelate; palpi absent; ovigera present in the male only, 5- or 6-jointed.

Genus *Phoxichilidium* Milne Edwards ('40, p. 535).

Orithya JOHNSTON ('37, p. 368).

Trunk slender, cylindrical; lateral processes well separated. Neck short, i.e., first trunk segment projects but little if at all beyond base of proboscis; emarginate between bases of chelifori. Proboscis comparatively short, cylindrical. Eye tubercle small, subconical. Caudal seg-

ment simple, pointing upward. Chelifori well developed; chelæ strong and curved. Ovigera 5-jointed, sigmoid; third joint with a constriction at about one third or less of its length; last joint nearly as large as fourth, armed with a few (one or more) rows of unguiform spines. Legs slender; *ts.1* small; *ts.2* well developed and armed at base with distally curved spines; *cl.* strong; *aux. cl.* distinct. Genital openings on second coxal joints of all the legs.

Remarks.—This genus has been made to include rather diverse forms, many of which, as stated by Sars, probably belong even to other families. Wilson ('78^a) removed from these into the genus *Anoplodactylus* those forms in which the first trunk segment projects considerably beyond the base of the proboscis, and which have 6-jointed ovigera. I accept the genus *Phoxichilidium* as restricted by Sars ('91), "principally characterized by the cephalic segment not projecting anteriorly beyond the base of the proboscis, the comparatively well-developed chelifori, and the structure of the false legs in the male," i.e., 5-jointed, with the last joint comparatively large. Sars concludes that but three species of the genus can be recognized with certainty, viz., *Ph. femoratum* (Rathke), *Ph. robustum* Dohrn, and *Ph. minor* Wilson. He considers the form described by Stimpson ('54) from the eastern coast of North America to be identical with *Ph. femoratum* of Europe; but Wilson ('78^b), in his description of *Ph. minor*, says (p. 14): "This species is closely similar to *P. maxillare*, of which it may be a dwarf variety"; and in a later paper ('80, p. 481) he adds that since the publication of the first paper "a much larger series of specimens has been obtained, which shows conclusively that the two forms cannot be separated, though extreme forms appear very unlike." Thus if *Ph. maxillare* is a synonym of *Ph. femoratum* it leaves but two species, *Ph. femoratum* and *Ph. robustum*, to be referred to this genus.

PHOXICHILIDIUM FEMORATUM (Rathke).

Plate XIII, fig. 10; plate XXIV, figs. 1-5.

Nymphon femoratum RATHKE, 1799, p. 201.

Orithya coccinea JOHNSTON, '37, p. 378, pl. XII, figs. 4-6.

Phoxichilidium coccineum MILNE EDWARDS, '40, p. 536.

Phoxichilidium coccineum GOODSIR, '44, p. 2, pl. 1, figs. 6-8.

? *Phoxichilidium globosum* GOODSIR, '42, p. 136, pl. III, fig. 1.

Phoxichilidium femoratum KRÖYER, '45, p. 122.

Phoxichilidium femoratum KRÖYER, '49, pl. XXXVIII, fig. 2, a-g.

? *Phoxichilidium femoratum* HOEK, '77, p. 6, Tab. XV, figs. 8-10.

? *Phoxichilidium femoratum* HOEK, '81^b, p. 512, pl. XXVI, figs. 18-21; pl. XXVII, fig. 19.

Phoxichilidium femoratum HANSEN, '84, p. 650.

Phoxichilidium femoratum HANSEN, '85, Tab. VII, fig. 21.

Phoxichilidium femoratum G. O. SARS, '88, No. 4.

Phoxichilidium femoratum G. O. SARS, '91, pp. 21-24, pl. II., fig. 1, a-g.

Phoxichilidium maxillare STIMPSON, '54, p. 37.

Phoxichilidium maxillare WILSON, '78^b, pp. 12, 13, pl. IV, figs. 1a-1e.

Phoxichilidium maxillare WILSON, '80, pp. 480, 481, pl. III, figs. 12-15.

Phoxichilidium minor WILSON, '78^b, pp. 13, 14, pl. IV, figs. 2a-2f.

Trunk cylindrical, tapering somewhat posteriorly; sutures well defined. Lateral processes about as long as width of trunk, well separated; except last pair, issuing from the middle of their respective trunk segments. First trunk segment longer than succeeding ones.

Caudal segment comparatively small, oval or oblong, unarmed.

Eye tubercle situated ahead of middle of first trunk segment, small, obtusely conical, the 4 eyes nearer the base; the posterior pair lower than the anterior.

Proboscis about the length of the first and second trunk segments together; cylindrical or somewhat clavate, being larger distally; obtusely truncate, with a circular constriction near the distal end. It arises somewhat ventrally from the first trunk segment; the ventral border starts obliquely downward, but soon bends forward at an obtuse angle.

Chelifori comparatively powerful, considerably longer than proboscis. Scape cylindrical or somewhat claviform; chela movably connected to it, usually carried somewhat downward, so as to overhang the proboscis; oval, smooth. Fingers powerful, about as long as palm; strongly curved, leaving an open space between, even when closed; the movable finger the longer and overlapping the other without crossing.

Ovigeras strong, about equal in length to the body. First joint short, about one and a half times as long as broad; *j.2* of smaller diameter, somewhat less than twice as long as first, and about equal to fourth; *j.3* longest, two and a half times *j.1*, curved slightly dorsalward, with a decided constriction at about one fourth of its length from the proximal end; *j.4* curved ventrally; *j.5* large, nearly as long as *j.4*, broad, compressed, arcuate, the appendage as a whole forming a sigmoid curve. On the basal half of the inner margin of this joint there are 3 closely set unguiform spines, while at either side occurs a set of feebler ones; other joints sparingly beset with exceedingly small, simple spiniform bristles.

Legs comparatively robust, two and one half to three times the length of the animal, smooth, except for microscopically minute spines. First coxal joint short, nearly square; *c.2* more than twice as long as *c.1*; *c.3* shorter again. Femoral joint longest, swollen in the female; tibial joints of about equal length, somewhat shorter than *f.* and about as long as coxal joint; both of less diameter than *f.*, and the second smaller

than the first. First tarsal joint very small, triangular, terminating dorsally as a small lappet, and slightly convex ventrally, where it is beset with a few slender bristles. Second tarsal joint beset with short spiniform bristles; the ventral ('inner') side is somewhat lamellarly expanded at the base, and is here armed usually with 6 strong, anteriorly curving spines, the 2 distal ones in most cases being in juxtaposition. Claw powerful, slightly curved, about half as long as *ts.2*; *aux. cl.* very small, though distinctly developed. At the distal end of *f.* are 1 or 2 strong bristles, and another projects from a slight depression on the dorsal side of *t.2*, a short distance from its distal end.

SPECIMENS EXAMINED.

Lot.	Locality.	No. of specimens.	Date.	Source.
3	Dutch Harbor, Unalaska	1♂, 1♀	July, 1899	H. A. E. (Prof. W. R. Coe)
5	Popof Id., Shumagin Group, Alaska	1♂	July, 1899	H. A. E. (Prof. T. Kincaid)
8	Popof Id., Shumagin Group, Alaska ¹	4♂, 1♀	July 8, 1899	H. A. E. (Prof. W. E. Ritter), Univ. of Calif., No. 19,512
24	Orca, Prince William Sound, Alaska	1♂	June, 1899	H. A. E.

Distribution.—If all the synonyms given above properly belong to this species its distribution covers a great range. It has been found along the coasts of the British Isles, Holland, Denmark, Norway, Greenland, the eastern coast of North America as far south as Massachusetts, and the present record extends its range to the western coast of North America from Orca to Unalaska. It ranges in depth from the shore rocks to 100 fathoms (Sars). Apparently it is a truly circumpolar species.

Remarks.—The specimens which I have examined from the Alaska coast agree very closely with the excellent description of this species given by Sars. They are, however, most of them considerably larger, the smallest specimen, from Orca, measuring about 3.5 mm., those collected at Popof Island 4.5 mm. to 5 mm., and those from Dutch Harbor 5.5 mm. from the tip of the proboscis to the tip of the caudal segment. Sars describes the color as "a more or less vivid red," or "sometimes dark-brownish or a sepia tint." Most of the Alaska specimens (alcoholic) are lighter than this, especially those from Dutch Harbor, which are a light brown or yellowish; the specimens from the Shumagins are a darker brown, and in 2 or 3 of them the branches of the intestine in the legs

¹"Undershore rocks."

show up very plainly as dark brown lines. Wilson says of "*Ph. maxillare*" that the color is "blackish or sepia to nearly pure white."

In the armature of the tarsal joints I find some variation from the description and figures of Sars. On the first I do not find one spine noticeably longer than the others, but a regular gradation up to the longest. In the majority of cases the second agrees with the description, but in various specimens the number of spines on the heel varies from 5 to 7, and the distal two are not always opposed to one another. The number and arrangement may vary on the different legs of the same specimen.

Genus *Halosoma*¹ gen. nov.

Trunk rather stout; lateral processes broad, first 3 pairs closely crowded; fourth pair separated from third by a space. Neck short but projecting somewhat beyond base of proboscis, which issues ventro-anteriorly from the first segment. Chelifori strong, chelate. Ovigera? Legs rather stout; second tarsal joint with expanded heel and a thin, chitinous, knife-like ridge along the sole. Claw well developed; auxiliary claws minute.

Remarks.—It was only after considerable hesitation that the present genus was instituted, as it is based upon a single specimen, and that evidently a female, though no ova could be made out in the ovaries. It seems, however, especially in the greater concentration, producing a stouter trunk and closely approximated lateral processes, to be generically distinct from both *Phoxichilidium* and *Anoplodactylus*; in the moderate development of the 'neck,' on the other hand, it is intermediate between those genera. It is unfortunate that the specimen does not possess ovigera, as the structure of those organs would help much in showing the position of this genus and its relation to the other genera. Should it prove to be an immature specimen which has not yet developed the ovigera, it is possible that it may be found to be related to the Pallenidæ rather than to the Phoxichilidiidæ. In either case the only thing to be done with it now seemed to be to describe it as a separate genus under the Phoxichilidiidæ, treating it as an adult female, until its true position can be determined by future collections.

HALOSOMA VIRIDINTESTINALIS sp. nov.

Plate xiv, fig. 11; plate xxiv, figs. 6-8; plate xxv, figs. 1-4.

Type.—University of California, No. 19,513, Dillon's Beach, Sonoma County, California.

Trunk stout, compressed; sutures deep and well marked; first segment

¹ From ἅλωσ, *disc*, and σῶμα, *body*.

about two and one half times as long as second. Lateral processes about as broad as long, a slight protuberance on the dorsal side distally; the first 3 pairs closely crowded; between the third pair and the fourth, which is directed posteriorly, is a considerable space, about half as wide as the process. First trunk segment projecting forward beyond the base of the proboscis a short distance, producing a thick neck, of moderate length.

Caudal segment rather long, over half as long as first trunk segment erect, subcylindrical, rounded at apex.

Eye tubercle about in the middle of the anterior half of the first trunk segment, directed slightly forward, shorter than caudal segment, conical; eyes at about the middle, large.

Proboscis issuing from the antero-ventral side of the first segment, as long as first and second trunk segments together, thick (half as long as broad), cylindrical, obtusely truncate, with a circular constriction near the distal end; ventral border with a projecting angle at the proximal end.

Chelifori stout, overhanging proboscis; scape reaching to about even with end of proboscis, slightly clavate; chelæ hanging downward almost vertically, with the movable finger on the outside. Palm slightly swollen; immovable finger slender, about as long as palm, slightly curved; movable finger slender, acuminate, arcuate.

Ovigeræ?

Legs rather stout: *c.1* short, squarish; *c.2* nearly double *c.1*, swollen on the ventral side, where genital pore is situated on posterior pairs; *c.3* slightly longer than *c.1*; *f.* about as long as coxal region, stout; *t.1* somewhat shorter than *f.*; *t.2* equals *t.1*; *ts.1* very short, irregularly triangular or squarish, with a few small spines on the ventro-distal corner; *ts.2* over half as long as *t.2*, somewhat arched, with a distinct heel at the base. Heel armed with 2 strong curved spines and 5 or 6 smaller ones; sole with a thin lamellar chitinous membrane (pl. xxv, fig. 4), in which are some 10 or 11 small spines; *cl.* equals about three-fourths of *ts.2*, nearly straight, inner margin slightly convex at middle; *aux. cl.* minute. The femoral and first tibial joints have slender bristles projecting from slight protuberances on the dorsal side and at their distal ends; *t.2* has a similar bristle a short distance from the distal end. Otherwise the legs are smooth except for a few microscopic hairs, as is the whole body.

Integument thin and transparent, the light green intestine with its prolongations into the legs showing through very distinctly, making the animal appear of a greenish color. Intestine considerably dilated in femoral joint. Cuticular cavities not so numerous as in related genera.

Length but slightly over 1 mm.; first leg about 3.5 mm.; extent 7.5 mm.

SPECIMEN EXAMINED.

Lot.	Locality.	No. of specimens.	Date.	Source.
28	Dillon's Beach, Sonoma Co., Calif.	1 ♀ (?)	Nov. 26, 1898	Univ. of Calif.

Remarks.—This single specimen was in a vial with *Lecythorhynchus marginatus* and *Ammothella tuberculata*. No data as to depth were given, but they were probably all taken in shallow water. It has the general appearance of a *Phoxichilidium*-like form, but is distinguished by its short, stout body and crowded lateral processes.

Genus *Anoplodactylus* Wilson ('78^a).*Phoxichilidium* (in part).

Trunk rather slender, with the first segment constricted anteriorly and extending forward some distance beyond the base of the proboscis, thus producing a long narrow neck. Lateral processes comparatively long and well separated. Proboscis projecting obliquely downward from ventral side of first trunk segment. Eye tubercle at extreme forward end of the segment. Chelifori comparatively feeble. Ovigera slender, 6-jointed; terminal joint very small. Egg-masses several, globular (*A. petiolatus et erectus*), or one or two, loose and more or less irregular in shape (*A. lentus*). Legs long, slender; first tarsal joint very short; ventral margin of second tarsal joint projecting at the base (the heel) and there armed with strong spines; auxiliary claws minute.

Remarks.—This genus can readily be distinguished from *Phoxichilidium*, which it much resembles in general appearance, by the long, projecting neck, the feeble chelifori, and the 6-jointed ovigera with the ultimate joint very much smaller than the penultimate.

Hoek ('98) lists the species which he considers as properly belonging to this genus. Besides the new species described below, I think the following should be added to his list: ¹

A. gestiens (Ortmann) = *Phoxichilidium gestiens* Ortmann, '91. Japan.

A. plumularia (von Lendenfeld) = *Phoxichilidium plumularia* von Lendenfeld, '83. Port Philip, Australia.

A. tubiferus (Haswell) = *Phoxichilidium tubiferum* Haswell, '85. Port Jackson, New South Wales.

¹ In a recent paper Möbius (:02) has referred two new species to the genus *Anoplodactylus*, viz., *A. aculeatus* and *A. spinosus*. The latter differs from the established genus in having 9-jointed ovigera, but in this connection Möbius says (p. 187): "Ich stelle für *Anoplodactylus spinosus* mit 9-gliedrigen Brutbeinen keinen neuen Gattungsbegriff auf, sondern scheide aus dem WILSON'schen Begriff *Anoplodactylus* das Merkmal einer bestimmten Gliederzahl der Brutbeine aus."

ANOPLDACTYLUS ERECTUS sp. nov.

Plate xiv, fig. 12; plate xxvi, figs. 1-9.

Type.—♂ and ♀, University of California, No. 19,514, San Diego, California.

Trunk rather slender, cylindrical, tapering posteriorly; lateral processes long, well separated, larger distally, where each has a small conical projection on the dorsal side and pointing somewhat outward. First trunk segment rather larger than the 2 following segments together; constricted in its anterior half and produced forward into a long narrow neck.

Caudal segment moderately long (nearly one and a half times second trunk segment); projecting upward at a sharp angle; approximately cylindrical, tapering to a point, often bulging somewhat in the middle, notched at tip; may be armed with 1 to 2 or 3 hairs on each side.

Eye tubercle placed at extreme forward end of first trunk segment and projecting upward and a little forward; about as long as second trunk segment, cylindrical. Viewed from the side it rounds evenly to a blunt point; viewed anteriorly or posteriorly it is seen to have a projecting angle on each side at the point of narrowing. Eyes nearer the top of the tubercle than the base; the anterior pair somewhat larger and a little lower than the posterior.

Proboscis about as long as first trunk segment, from the posterior part of which it issues ventrally and projects obliquely downward and forward; basal portion of slightly smaller diameter than the distal; truncate.

Chelifori extending forward from the extreme end of the first trunk segment, which furnishes but a slight projection beyond the eye tubercle for their attachment; about equal in length to the segment to which they are attached. Scape slender, nearly cylindrical, only slightly enlarged at distal end; smooth except for a few small hairs. Chela pendant, bent at nearly a right angle to the scape and hardly half as long, sparingly beset with hairs; fingers slender, curved, sharply pointed, about as long as palm; movable finger longer and more strongly curved.

Ovigeras long (as long as, or longer than, animal), slender. First joint short and comparatively thick; *j.2* over twice as long and more slender; these 2 joints extend downward from their attachment to the first trunk segment. The third joint bends backward, running nearly parallel with the trunk; it is half again as long as the first two joints taken together and even more slender than the second; slightly curved, with the convexity upward; about one fourth of its length from the proximal end is a constriction which on superficial examination might be taken for an

articulation. The fourth joint is somewhat shorter than the second, slightly curved; *j.5* still shorter and bent sharply back on the under side of the fourth; *j.6* very small, oval; the fifth and sixth together scarcely equal the fourth. The third, fifth, and sixth joints are sparingly beset with rather stiff bristles, some of which on *j.6* are directed backward.

Eggs on ovigera in several globular masses.

Legs slender, second pair about two and one half times as long as the animal; *c.1* short, little longer than broad; *c.2* rather over twice the length of *c.1*; at about the middle of the dorsal side is a slight rounded protuberance; in the male the ventral side extends at the distal end into a considerable projection, on which are several small bristles, and at the end of which is the genital opening. The female lacks this projection, but the distal end of the joint is swollen and the genital opening is situated on a slight prominence of its own a little way back from the tip. Third coxal joint rather longer than first; like all the joints out to *t.2*, it becomes gradually larger distally. Femoral joint nearly as long as whole of coxal region, commonly larger in the female; produced dorsally at the distal end into a rounded projection very similar in shape to that on the dorsal side of the lateral process and the genital prominence on the second coxal joint; from this projection grows a long, slender bristle. In the male there is another process on the femoral joint, just beyond the middle on the dorsal side; it is drawn out into a narrow tube which projects distally; at its end is the opening of the so-called agglutinative gland, the secretion from which is supposed to be used in gluing the egg-masses together. Second tibial joint slightly longer than *t.1*; neither quite so long as *f.*; at the distal end of *t.1* is a projection similar to that on *f.*, but smaller, and likewise furnished with a rather long bristle; about one fourth of the distance from the distal end of *t.2*, on the dorsal side, is a slight nodular protuberance from which projects a long, delicate bristle. First tarsal joint very small, roughly triangular, with a broad base ventrally bearing a few moderately strong spines, and a narrow knob dorsally; *ts.2* comparatively slender, about equal in length to *c.2*, not strongly curved, but appearing arched on the ventral side in consequence of being much expanded at the base, where it is armed with 2 stout, distally curved spines and a few strong bristles. The proximal half of the remainder of the ventral margin, the sole, is armed with a series of close-set distally curved spines, varying in number from 7 or 8 to 11; along the distal part extends a thin, lamellar, knife-like chitinous plate along the sides of which are a few very small bristles. Claw long, falciform, reaching back as far as the heel of *ts.2*; inner edge thin and knife-like. Auxiliary claws very small but distinct. The legs are very sparsely hairy; besides what have

been mentioned, there are a few fine hairs, especially on *f.*, *t.1*, *t.2*, and *ts.1*, and a more or less regular row of small bristles along the dorsal side of *ts.2*.

Integument thin, clear, and with comparatively few cuticular cavities. Color in alcohol light.

Length about 2.5 mm.; sexes of nearly the same size.

SPECIMENS EXAMINED.

Lot.	Locality.	No. of specimens.	Date.	Source.
13	San Diego, Calif.	6♂, 1♀	Sept., 1896	Univ. of Calif. (coll. by Prof. Kelsey) Dr. S. J. Holmes
15	San Diego, Calif.	1♀	July 8, 1895	

Remarks.—This species of *Anoplodactylus*, which I have called *erectus* on account of the position of the caudal segment, is in many respects very similar to *A. petiolatus* (Kröyer). The important differences are shown in the following table:

A. petiolatus.

Trunk "somewhat short and stout, and, relatively to its length, rather broad."

Lateral processes not much separated.

Caudal segment long, cylindrical, abruptly acuminate, placed horizontally.

Proboscis of plain cylindrical form, obtusely truncated.

Immovable finger of chela almost quite straight.

Ovigeras nearly as long as animal.

Legs hardly two times length of animal.

Second tarsal joint strongly curved; 4 to 6 spines on proximal part of sole.

A. erectus.

Trunk rather slender.

Lateral processes well separated.

Caudal segment not especially long, more or less conical, directed upward at a sharp angle.

Proboscis not plain cylindrical, narrower in basal portion.

Fingers of chela both curved.

Ovigeras as long as, or longer than, animal; third joint especially proportionately longer than in *A. petiolatus*.

Legs proportionately longer; two and one half times length of animal.

Second tarsal joint not strongly curved; 7 to 11 spines on proximal part of sole.

Family *PYCNOGONIDÆ*.

Chelifori and palpi both absent; ovigera present in the male only

Genus *Pycnogonum* Brünnich (1764).

Trunk stout and square-set. Ovigera small, present only in the male, 9- or 10-jointed. Legs comparatively short, stout, tapering. First tarsal joint small; claw powerful; auxiliary claws usually absent.

Remarks.—There seems to be a disagreement among authors as to whether in this genus the ovigera are 9-jointed or 10-jointed. This is probably due to the fact that some count the terminal claw as a joint, while others do not; but as it differs from the others only in being smaller and more chitinous, I see no reason why it should not be considered a joint the same as the terminal claw of the legs.

PYCNOGONUM STEARNSI Ives.

Plate XIV, figs. 13–15; plate XXVI, fig. 10.

Pycnogonum stearnsi IVES, '92, p. 142, pl. X, figs 1–4.

Trunk broad, somewhat depressed; lateral processes with scarcely any interval between them. Each trunk segment with a prominent tubercle at its posterior border on the mid-dorsal line (considerably smaller on the last segment), and a somewhat smaller tubercle on the outer edge of each lateral process. First trunk segment about two thirds the length of the proboscis, slightly constricted just ahead of the lateral processes; second and third segments each equal to the portion of the first back of the constriction; the fourth somewhat shorter. Posterior borders of the segments slightly elevated.

Caudal segment clavate, or nearly cuneiform, truncated at its extremity, sometimes slightly swollen in the middle; somewhat longer than the fourth trunk segment, about equal to the third. The anus is a longitudinal slit on the ventral side of the caudal segment near the tip.

Eye tubercle bluntly conical, placed just behind the constriction of the first segment; eyes black or dark brown, distinct, or in some cases indistinct and without pigment; the posterior pair usually farther apart than the anterior.

Proboscis subcylindrical, slightly swollen at or a little anterior to the middle; somewhat longer than the first trunk segment.

Ovigera (pl. XXVI, fig. 10) small and rather slender; 10-jointed, the last joint a strong, straight, or nearly straight, claw. The joints do not diminish gradually in length; the first, second, fourth, seventh, and eighth are approximately as long as broad, while the others are proportionately longer. The diameter does not decrease greatly until the ninth

joint, where it begins tapering gradually to the tip of the claw. Practically smooth except for a few very small bristles on the outer side of the third joint. When not carrying eggs, the appendages commonly extend outward and a little backward, then curve forward and in again toward the middle line. The bending occurs particularly at the fourth and at the eighth and ninth joints.

Eggs small, carried on the ovigera in one (pl. xiv, fig. 15) or two (fig. 14) large, wrinkled, cake-like masses, occupying the whole space under the animal and extending so far that when looked at from below only the legs from the fourth joint outward are visible, except the posterior pair, which can usually be seen because the eggs are carried well forward.

Legs stout: *c.1* broader than the lateral processes of the segments, with the appearance of a dorsal notch on its outer border due to the close approximation of two dorsal tubercles; *c.2* rather smaller than *c.1*; *c.3* rather smaller than *c.2*; the 3 joints together in the third leg about as long as the proboscis; *f.* strongly developed, about two thirds as long as the coxal region; proximal half of the ventral surface considerably swollen (in male as well as female), a rather weak dorsal tubercle at the distal extremity; *t.1* about equal to *f.*, but more slender; *t.2* rather shorter than *t.1*; *ts.1* very short, subtriangular; *ts.2* about as long as *t.2*; *cl.* less than half as long as *ts.2*, rather strongly curved. On the dorsal surface of *f.*, and of *t.1* and *t.2*, near their distal ends, there is a single comparatively strong spine; ventral side of *t.2* beset with smaller spines at its distal end, while the tarsal joints, especially the first, have their ventral surfaces thickly beset with these short spines.

The 11 females measured range from 4 mm. to 8 mm.; the males average somewhat smaller, the largest being but 6.3 mm. in length.

SPECIMENS EXAMINED.

Lot.	Locality.	No. of specimens.	Date.	Source.
11	San Pedro Point, San Mateo Co., Calif.	2♂, 2♀	Sept. 1, 1895	Univ. of Calif.
17	Pacific Grove, Monterey Co., Calif.	1♀	July 13, 1896	Univ. of Calif.
19	Dillon's Beach, Sonoma Co., Calif.	2♀	Aug. 4, 1898	Univ. of Calif.
21	Shelter Cove, Humboldt Co., Calif. ¹	14♂, 6♀	June 24, 1894	Univ. of Calif., No. 19,516

Remarks.—This species was established by Ives from 5 female specimens collected at San Diego, and it has not been recorded since that

¹ Collected "on rocks." Ten of the fourteen males in this lot were carrying egg-masses.

time until now. Ives's description and figures are readily recognizable, and besides being able to include the description of the male I have very little to add.

Pycnogonum stearnsi is closely allied to *P. littorale* (Ström). The principal differences can be seen at a glance in the following table:

<i>P. littorale.</i>	<i>P. stearnsi.</i>
Average length of female about 15 mm.	Average length of female about 6 mm.
Claw more than half the length of the second tarsal joint.	Claw less than half the length of the second tarsal joint.
A smaller conical protuberance on the dorsal side of the first trunk segment between the one on the posterior border of the segment and the eye tubercle.	No protuberance on the first trunk segment between the one on the posterior border and the eye tubercle.
Ovigeræ: "Along the inner margin of the joints extend a few very small and irregularly distributed spines of quite a simple form" (Sars, '91, p. 10).	Ovigeræ practically unarmed except for a few small spines on the outer side of the third joint.

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PLATE XI.

- FIG. 1. *Lecythorhynchus marginatus* sp. nov., male (Lot 10), from above; showing egg-masses below.
2. *Lecythorhynchus marginatus* sp. nov., male (Lot 10), from below; showing egg-masses attached to the ovigera.
3. *Ammonothea latifrons* sp. nov., female (Lot 1), from above.

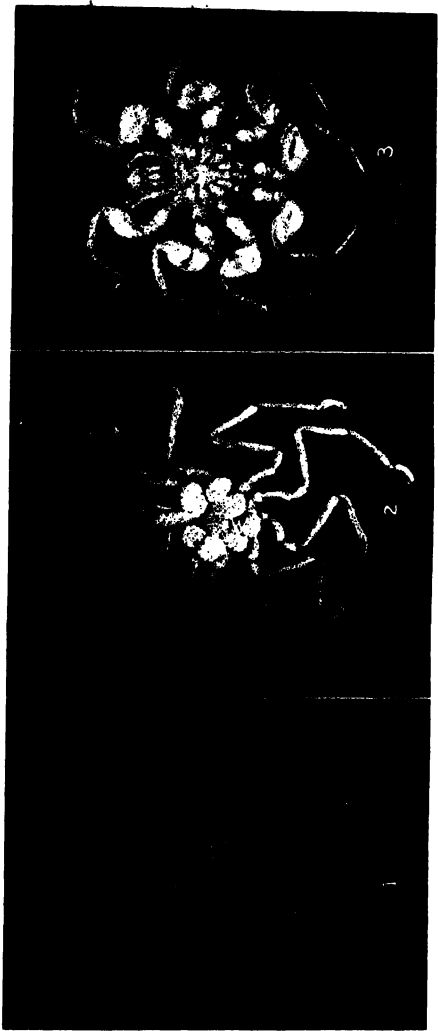
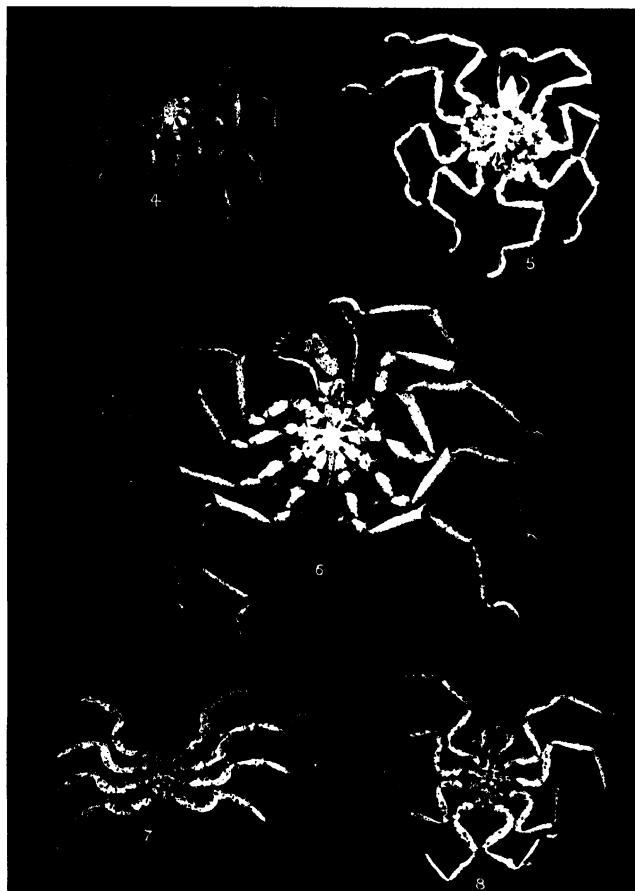


PLATE XII.

- FIG. 4. *Ammothea alaskensis* sp. nov., male (Lot 25), from above.
5. *Ammothea gracilipes* sp. nov., male (Lot 9), from above; showing egg-masses below.
6. *Ammothea pribilofensis* sp. nov., male (Lot 23), from above.
7. *Ammothella tuberculata* sp. nov., female (Lot 22), from above.
8. *Ammothella spiniferu* sp. nov., female (Lot 14), from above.



PYCNOGONIDA

PLATE XIII.

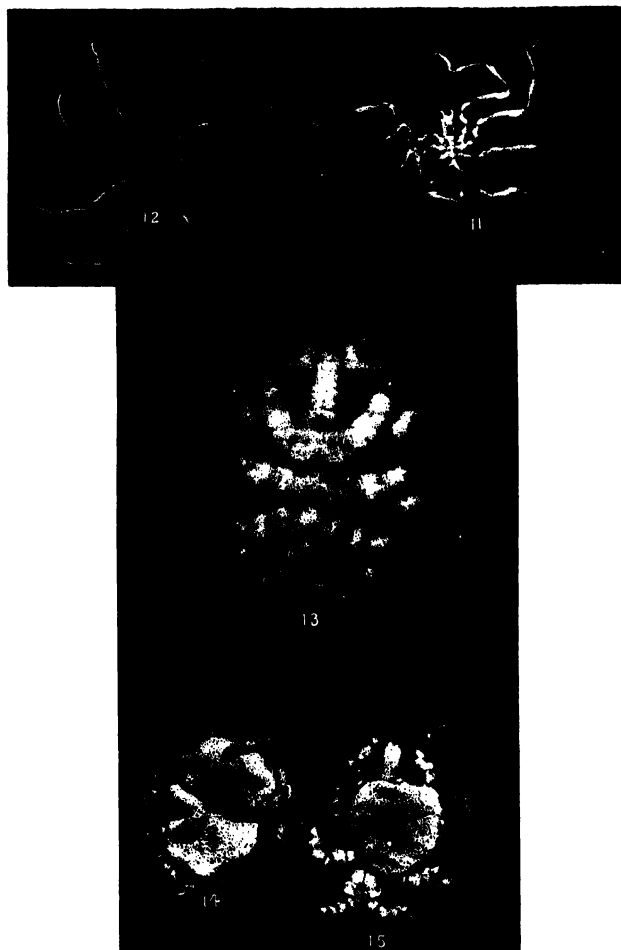
FIG. 9. *Clotenia occidentalis* sp. nov., male (Lot 16), from above. (The peculiar ragged appearance of this specimen is due partly to adhering particles of dirt.)

10. *Phoxichilidium femoratum* (Rathke), male (Lot 5), from above.



PLATE XIV.

- FIG. 11. *Halosoma viridintestinalis* gen. nov., sp. nov., female (?) (Lot 28), from above.
12. *Anoplodactylus erectus* sp. nov., male (Lot 13), from above.
13. *Pycnogonum stearnsi* Ives, female (Lot 17), from above.
14. *Pycnogonum stearnsi* Ives, male (Lot 21), from below; carrying two egg-masses.
15. *Pycnogonum stearnsi* Ives, male (Lot 21), from below; carrying a single egg-mass.

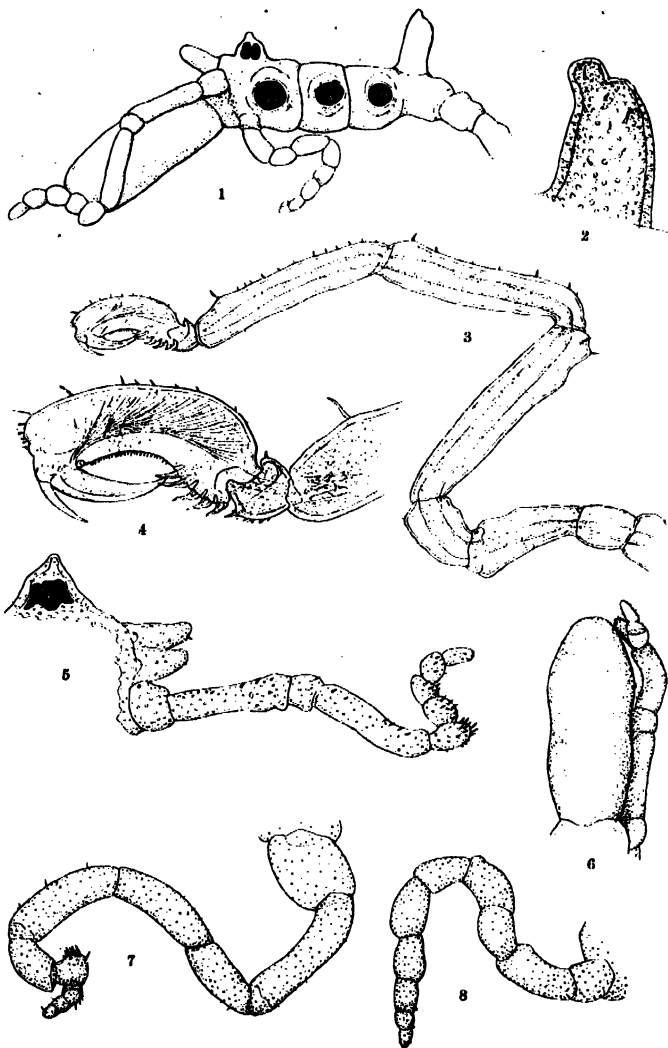


YONOGONIDEA

PLATE XV.

Lecythorhynchus marginatus sp. nov.

- FIG. 1. Female from left side (Lot 18). $\times 20$.
2. Caudal segment seen from left side; male (Lot 20). $\times 53$.
3. Third right leg of male (Lot 20). $\times 20$.
4. Foot of same. $\times 43$.
5. Eye tubercle, chelifori and right palp of male (Lot 20); seen from the side.
 $\times 33$.
6. Proboscis and right palp seen from above. $\times 25$.
7. Left oviger of male (Lot 20). $\times 33$.
8. Right oviger of female (Lot 20). $\times 33$.



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PLATE XVI.

Ammothea latifrons sp. nov.

- FIG. 1. Male from right side (Lot 1). $\times 20$.
2. Lateral process and first coxal joint of third left leg of male (Lot 1); seen from dorsal side. $\times 20$.
3. Second right leg of male (Lot 1b). $\times 20$.
4. Second coxal joint of third right leg of male (Lot 1b). $\times 20$.
5. Palp of female (Lot 1a). $\times 33$.
6. Oviger of female (Lot 1a). $\times 33$.
7. Oviger of male (Lot 1c). $\times 33$.
8. Cheliforus of female (Lot 1a). $\times 33$.
9. Denticulate spine from oviger of male (Lot 4b). $\times 247$.

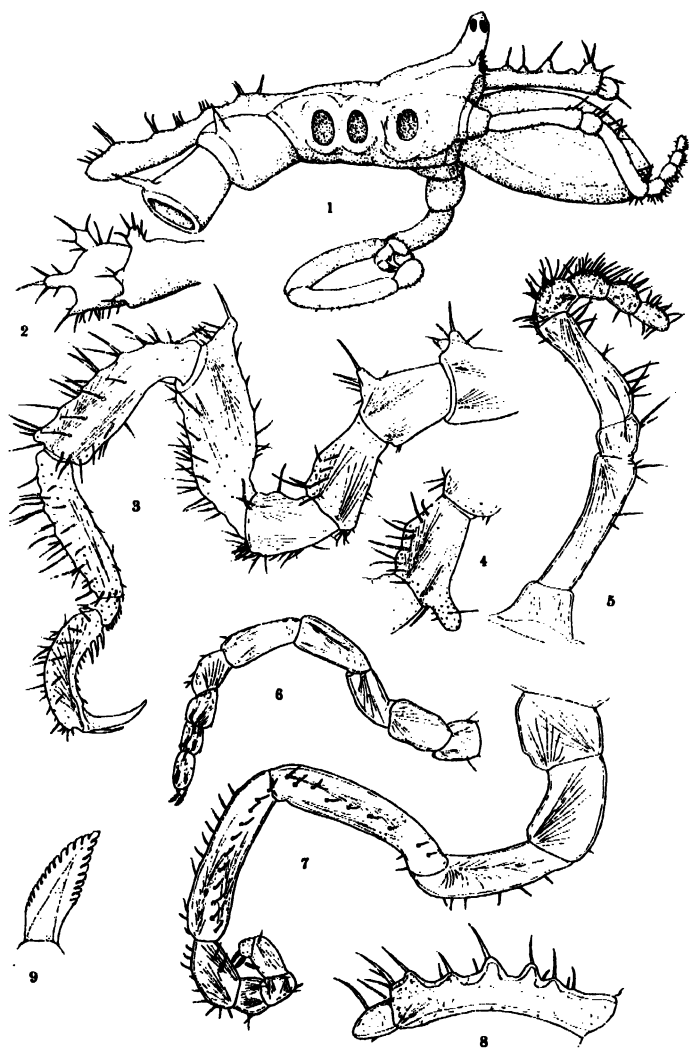


PLATE XVII.

Ammothea latifrons sp. nov.

- FIG. 1. Cheliforus of immature specimen (Lot. 1-1). $\times 33$.
2. Oviger of immature specimen (Lot 1-1a). $\times 33$.
3. Terminal part of same. $\times 107$.

Ammothea alaskensis sp. nov.

4. Female from left side (Lot 25). $\times 27$.
5. Cheliforus of adult (Lot 7b). $\times 73$.
6. Caudal segment, dorsal view (Lot 7b). $\times 43$.
7. Left oviger of female (Lot 7a). $\times 73$.
8. Right palp of female (Lot 7b). $\times 73$.
9. Third left leg of female (Lot 25a). $\times 27$.
10. Foot of second left leg, female (Lot 7a). $\times 53$.
11. Second coxal joint of third left leg of male (Lot 25). $\times 27$.
12. Right oviger of male (Lot 25b). $\times 37$.

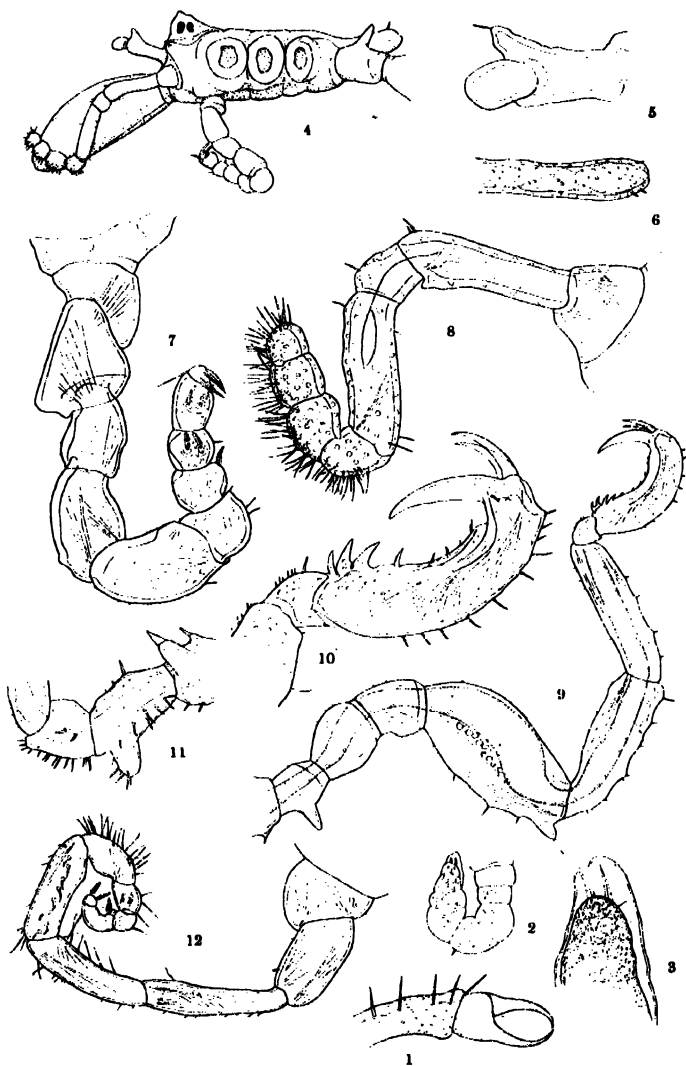


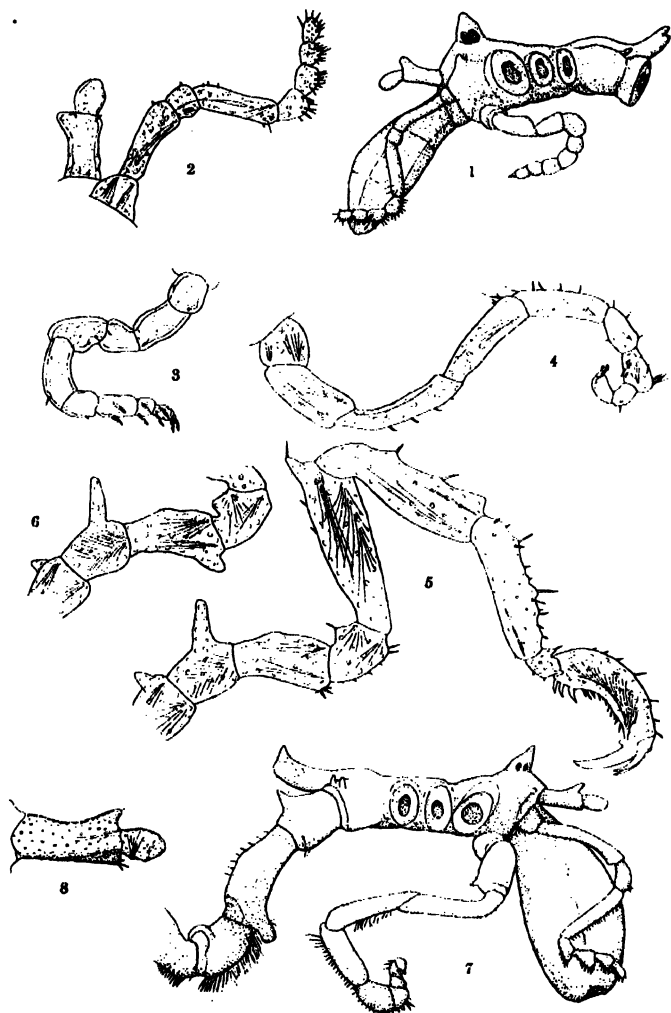
PLATE XVIII.

Ammothea gracilipes sp. nov.

- FIG. 1. Female from left side (Lot 9). $\times 27$.
2. Right cheliforus and palp of female (Lot 9a). $\times 43$.
3. Right oviger of female (Lot 9a). $\times 43$.
4. Left oviger of male (Lot 9b). $\times 43$.
5. Second right leg of male (Lot 9b). $\times 33$.
6. Lateral process and coxal joints of third right leg of male (Lot 9b). $\times 33$.

Ammothea pribilofensis sp. nov.

7. Male from right side (Lot 2). $\times 11$.
8. Left cheliforus of male (Lot 2a). $\times 20$.



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PLATE XIX.

Ammothea pribilofensis sp. nov.

- FIG. 1. Left palp (Lot 2a). $\times 20$.
2. Lateral process and first coxal joint of first left leg of male (Lot 2); dorsal view.
3. Left cheliforus of immature specimen (Lot 2-1); dorsal view. $\times 20$.
4. First right leg of male (Lot 2a). $\times 10$.
5. Heel of same. $\times 20$.
6. Second coxal joint of third right leg of male (Lot 2a). $\times 10$.
7. Left oviger of male (Lot 2a). $\times 20$.
8. Oviger of female (Lot 2b). $\times 20$.

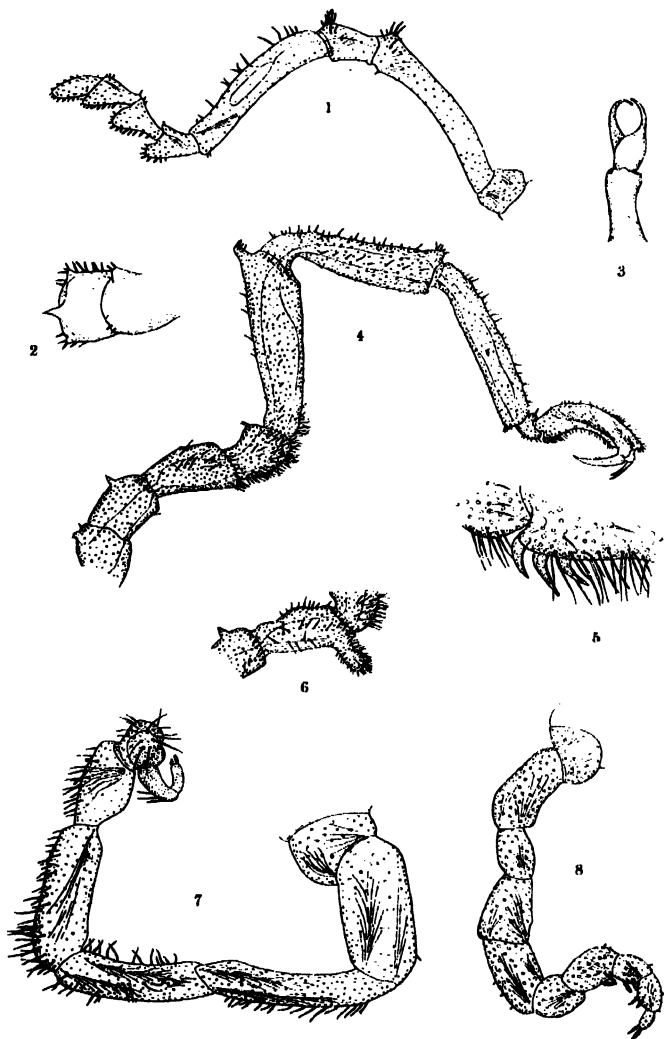


PLATE XX.

Ammothella tuberculata sp. nov.

- FIG. 1. Female from left side (Lot 27). $\times 20$.
2. Female specimen from dorsal side (Lot 22). $\times 20$.
3. Right cheliforus of female (Lot 27). $\times 37$.
4. Right palp and right oviger of female (Lot 27). $\times 37$.
5. Second left leg of female (Lot 27). $\times 33$.
6. Right cheliforus of female (Lot 22a). $\times 43$.

Ammothella spinifera sp. nov.

7. Female from right side; chelifori, palpi, and proboscis not shown; portion of side cut away, exposing alimentary canal and nerve ganglia (Lot 14). $\times 43$.
8. Eye tubercle of immature specimen seen in posterior view (Lot 14). $\times 70$.
9. Proboscis (Lot 14). $\times 33$.

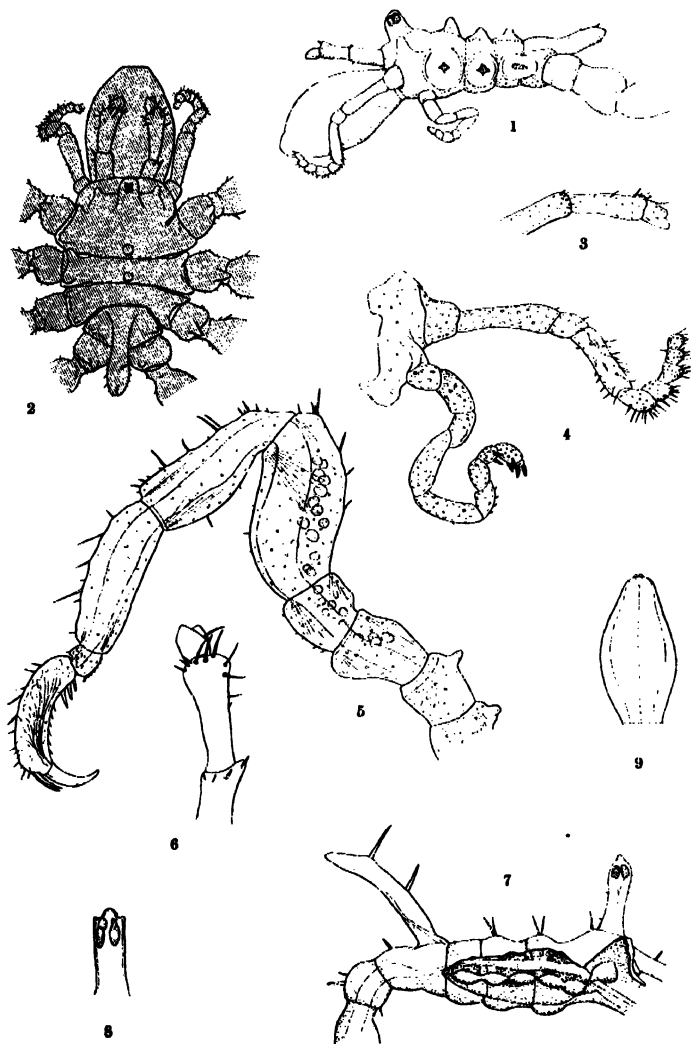


PLATE XXI.

Ammothella spinifera sp. nov.

- FIG. 1. Female from above (Lot 14). $\times 27$.
2. Left oviger of female (Lot 14a). $\times 70$.
3. Left cheliforus of female (Lot 14a). $\times 70$.
4. Left cheliforus of immature specimen from above (Lot 14). $\times 70$.
5. First left leg of female (Lot 14a). $\times 43$.
6. Left palp (Lot 14). $\times 70$.

Tanystylum intermedium sp. nov.

7. Male from right side (Lot 29). $\times 40$.
8. Right cheliforus of male (Lot 29b); from above. $\times 107$.
9. Right cheliforus of immature specimen (Lot 29). $\times 107$.

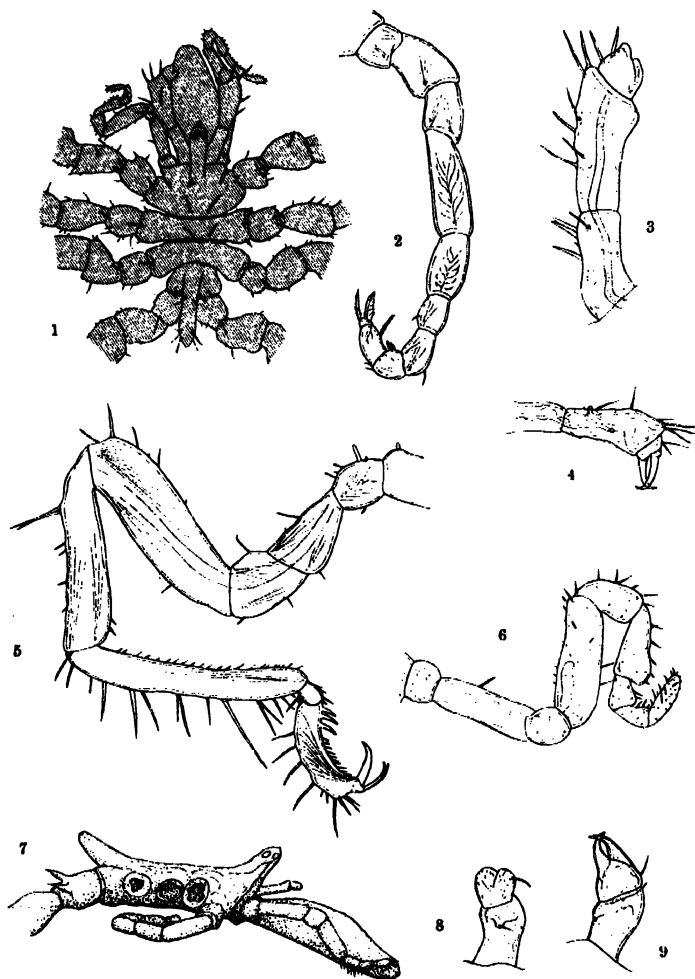
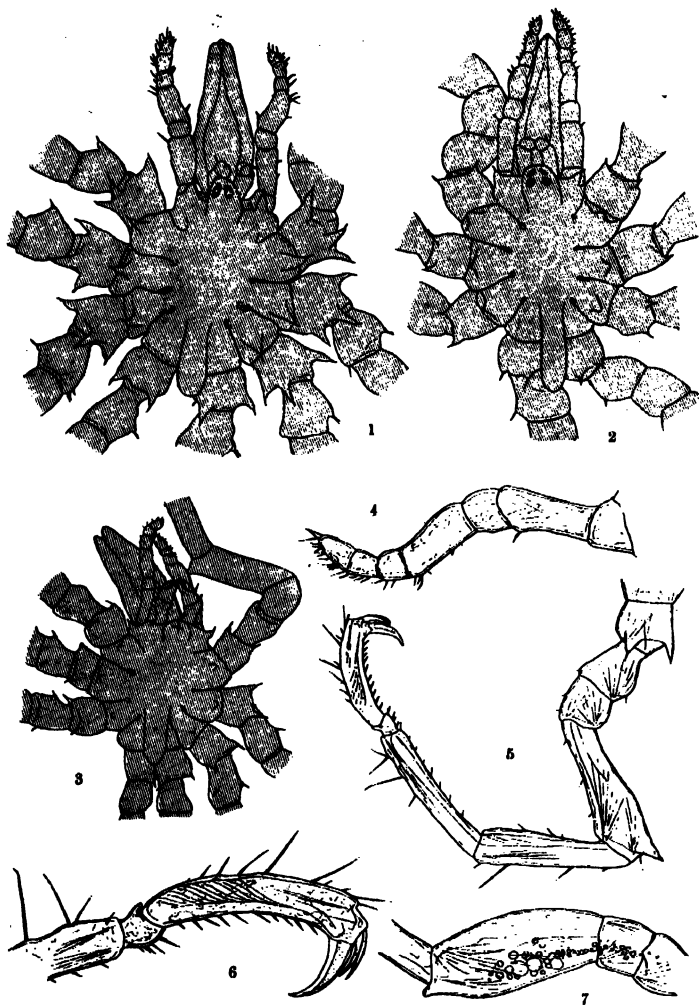


PLATE XXII.

Tanystylum intermedium sp. nov.

- FIG. 1. Male from above (Lot 29). $\times 44$.
2. Female from above (Lot 29). $\times 44$.
3. Immature specimen from above (Lot 29). $\times 44$.
4. Left palp of female (Lot 29a). $\times 70$.
5. Second right leg of male (Lot 29b). $\times 43$.
6. Foot (Lot 29b). $\times 80$.
7. Femoral joint of second left leg of female (Lot 29a). $\times 43$.



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PLATE XXIII.

Tanystylum intermedium sp. nov.

- FIG. 1. Left oviger of male (Lot 29a). $\times 70$.
2. Left oviger of female (Lot 29a). $\times 70$.
3. Spine from joint 9 of above (Fig. 2) highly magnified

Clotenias occidentalis sp. nov.

4. Male from right side (Lot 16). $\times 34$.
5. Cheliferous and palp of same. $\times 70$.
6. Third right leg of same. $\times 33$.
7. Left oviger of same. $\times 70$.
8. Same specimen from above. $\times 33$.

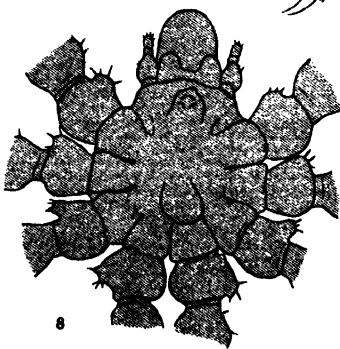
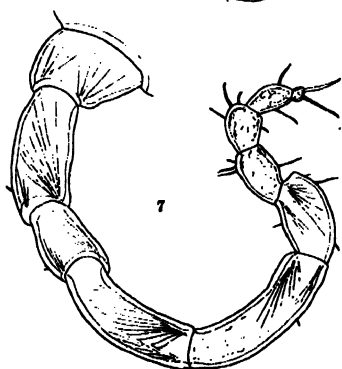
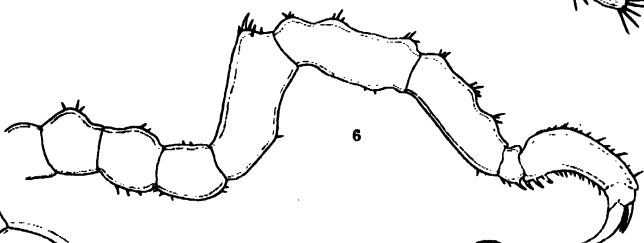
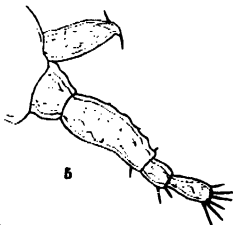
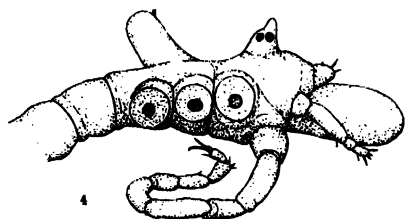
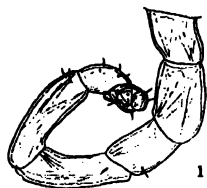


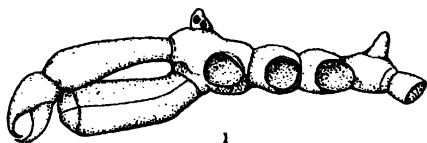
PLATE XXIV.

Phoxichilidium femoratum (Rathke).

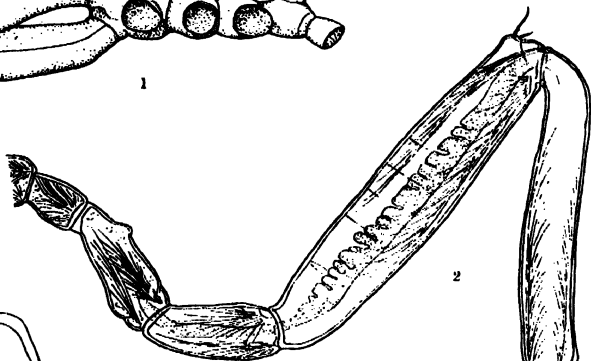
- FIG. 1. Female from side (Lot 3). $\times 10$.
2. Second left leg of female (Lot 3). $\times 13$.
3. Eye tubercle, anterior view (Lot 3). $\times 43$.
4. Caudal segment, posterior view (Lot 3). $\times 43$.
5. Right oviger of male (Lot 8). $\times 20$.

Halosoma viridintestinalis gen. nov., sp. nov.

6. From left side (Lot 28). $\times 43$.
7. Left chela of same. $\times 107$.
8. Same as Fig. 7, cleared and mounted. $\times 107$.



1



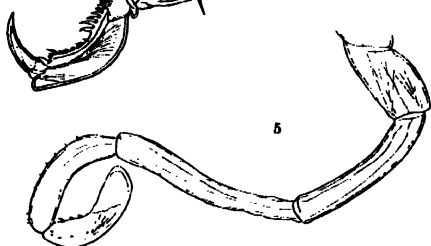
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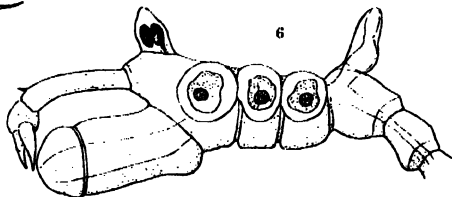
5



6



7



8

PLATE XXV.

Halosoma viridintestinalis gen. nov., sp. nov.

- FIG. 1. Specimen from above (Lot 28). $\times 20$.
2. Second left leg of same. $\times 43$.
3. Foot of same. $\times 67$.
4. Portion of the sole highly magnified.



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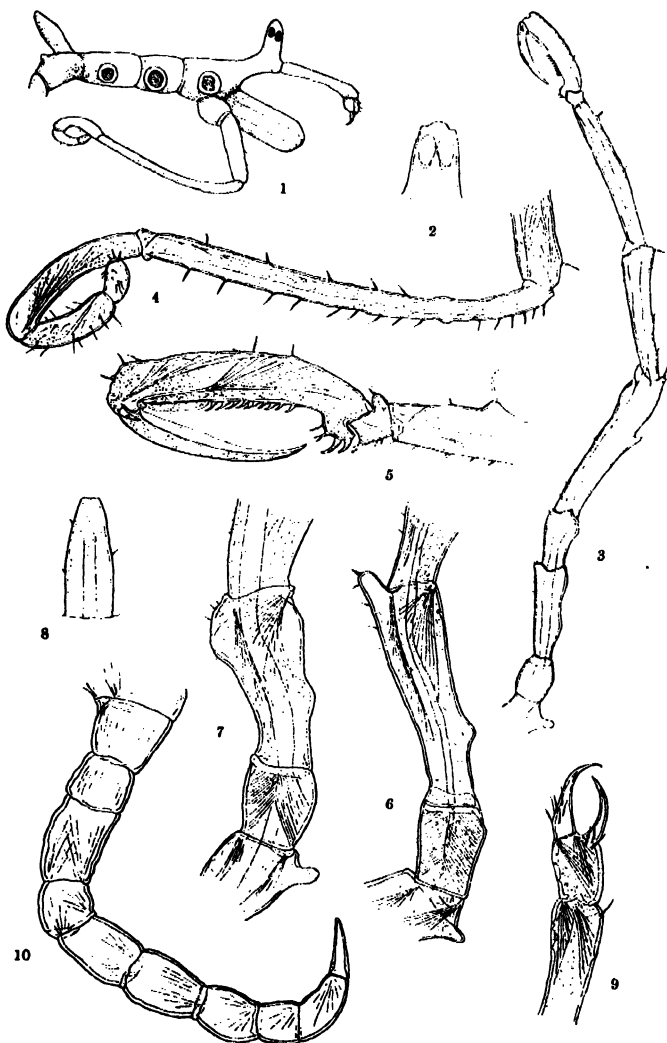
PLATE XXVI.

Anoplodactylus erectus sp. nov.

- FIG. 1. Male from side (Lot 13). $\times 20$.
2. Eye tubercle of female (Lot 13); posterior view. $\times 43$.
3. Third right leg of male (Lot 13b). $\times 20$.
4. Terminal part of left oviger of same specimen. $\times 53$.
5. Foot of Fig. 3. $\times 53$.
6. Second coxal joint of fourth right leg of male (Lot 13c).
7. Second coxal joint of second right leg of female (Lot 13c).
8. Caudal segment of female (Lot 13); anterior view. $\times 43$.
9. Left chela (Lot 13c). $\times 67$.

Pycnogonum stearnsi Ives.

10. Left oviger of male (Lot 21-1). $\times 27$.



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